

## **4–6 Module**

### **Unit 2 Reducing, Reusing, and Recycling**

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*The lessons in this unit flowed well, were highly motivating, and led to understanding of the importance of recycling with applications.*

— Janet Cohen, sixth-grade teacher, Gold Trail Elementary School, Gold Trail Union School District

# 4-6 MODULE

## Unit 2: Reducing, Reusing, and Recycling

### Overview

#### UNIT 2'S CONCEPTS

- Reducing the amount of materials we buy and reusing and recycling the materials we have helps conserve natural resources. People need to exercise judgment, care, and planning in their use of natural resources. (*Science Framework*, p. 125)
- Responsible individuals analyze the long-term effects, costs, benefits, and trade-offs of their lifestyle choices. They take responsible action by practicing waste reduction and waste management strategies in their communities, schools, and homes. ("Conceptual Matrix for Integrated Waste Management Education")

The 12 lessons in this unit are described in the outline that follows.

#### LESSON 1: SOURCES OF ENERGY

##### Lesson's concepts:

- Energy is the ability or capacity for doing work by a body or system, and energy is required for any change to take place. The word *energy* can also describe resources used for producing power; e.g., solar energy, fossil fuel energy.
- Various sources of energy are used to make a variety of objects and to provide power to operate certain objects.

In Lesson 1 students will:

- Define the word *energy*.
- Identify the sources of energy people use to make and operate various objects and determine which of these are considered renewable or nonrenewable.
- Determine what things they enjoy doing that requires using objects and identify the energy sources and other natural resources used to make or to use these objects.
- Develop a game to teach others about energy sources and other natural resources and the importance of conserving them.

#### LESSON 2: PERFORMING A CLASS AUDIT OF WASTE

##### Lesson's concept:

Analyzing the source and content of a waste

stream is the first step in learning how to reduce, reuse, and recycle.

In Lesson 2 students will:

- Observe the amount of waste generated by the class.
- Categorize the waste from their classroom by type of material from which products were made, and analyze each category by weight, volume, and number of items.
- Calculate the percent of waste by type of material and determine how much waste is generated by the class in one day, one month, and one year.
- Attempt to reduce the amount of waste they dispose of in the class's garbage can over a one-week period and complete charts to show their progress.
- Design a plan to reduce in the classroom the amount of waste that would have been placed in a landfill.

#### LESSON 3: MODEL COMMUNITY RELAY

##### Lesson's concepts:

- People can reduce their solid waste by learning the ways that waste can be sorted, according to the materials which can be reused and recycled.
- Through the process of reusing and recycling, people can save the energy and natural resources it takes to acquire and manufacture items from raw materials.

In Lesson 3 students will:

- Listen to and/or read parts of *Recycle!* by Gail Gibbons to identify the difference between reusing and recycling.
- Use clay to mold a new item and/or make recycled paper in order to understand the process of recycling.
- Compare reusing to recycling.
- Work in teams and participate in a relay race to show how waste can be diverted from a landfill through reusing and recycling practices.

## **LESSON 4: PACKAGING: WHAT A WASTE!**

### **Lesson's concepts:**

- Packaging is useful and necessary for many reasons.
- Packaging is a major component of the waste stream. People can reduce the amount of garbage they generate by making thoughtful and informed choices when they buy packaged products.
- Excessive packaging and processing can waste natural resources and increase the amount of solid waste requiring disposal.

In Lesson 4 students will:

- Determine the purposes of a variety of packaging.
- Identify the materials used in packaging.
- Compare the amount of packaging and costs of the same product when placed in a large package as compared to being packaged in individual containers.
- Work in groups to compare the costs of various potato products that are processed and packaged differently.
- Classify packaging according to categories, based on the purpose or function of the packaging.
- Evaluate wasteful packaging.
- Recognize packaging made from recycled materials.

## **LESSON 5: WHY DO I BUY IT?**

### **Lesson's concepts:**

- Practicing waste prevention is an effective way to cut down on solid waste.
- An individual's informed and careful buying decisions, which include considering waste disposal and recycling, can significantly

reduce the volume of household waste.

- Solid waste contains increasingly more disposable (one-time use) objects and synthetic materials.
- If people reduce the number and types of goods they purchase, fewer goods will need to be manufactured and fewer natural resources will be used.

In Lesson 5 students will:

- Listen to or read *The Lorax*, by Dr. Seuss.
- Develop advertisements for products that are not really needed and for products that have many uses.
- Identify some of these products as they pertain to their lives.
- Complete a questionnaire on why they and their classmates buy things.
- Work in groups to analyze disposable and durable items.
- Develop a criteria for selecting and purchasing products which use less energy and fewer resources.
- Keep a log of what they buy and analyze their purchases.

## **LESSON 6: REUSING TRASH**

### **Lesson's concept:**

Reusing products helps reduce waste and conserve natural resources and landfill space.

In Lesson 6 students will:

- Participate in guided imagery to focus on how an item can be reused.
- Brainstorm ways a milk carton can be reused and then work in groups to design new uses for two milk cartons.
- Listen to or read *Galimoto* by Karen Lynn Williams and describe the efforts of the boy in the story to reuse wire to make a toy.
- Provide examples of items they can gather to make a new item.
- Participate in two skits about reusing materials and write additional parts to the skits.
- Select an item at home that would have been thrown away, reuse it in a creative way, and bring the item to class or write a description of how the item was reused to share with class members.

## **LESSON 7: PLASTIC POLYMERS**

### **Lesson's concepts:**

- Properties of different plastics can be identified.
- Some plastics can be reused or recycled.

In Lesson 7 students will:

- Conduct a series of tests to determine the properties of different types of plastics.
- Test plastics for decomposition by burying them for several weeks.
- Develop a rubric for assessing the value of their invention of new uses for a plastic item.
- Invent new uses for a plastic item.
- Audit the plastic waste generated in their homes.
- Identify new practices which would generate less plastic waste.

## LESSON 8: SEPARATION MANIA

### Lesson's concept:

Waste can be sorted by physical properties, and some waste materials can be recycled.

In Lesson 8 younger students will:

- Identify specific properties of recyclable items by determining which items sink or float, are magnetic, can be moved by wind, or can be easily cut or shredded.
- Compare different characteristics of recyclable materials.
- Determine ways to sort recyclable materials.

In Lesson 8 older students will:

- Use several mechanisms to separate ten different recyclable waste items and record the results on a data sheet.
- Identify specific properties of recyclable items by determining which items sink or float, are magnetic, can be moved by wind, or can be easily cut or shredded.
- Recognize that the techniques they used to separate certain recyclable items are similar to the ways used to separate recyclables at a materials recovery facility.
- Work in groups to develop an efficient design for the separation process, based on the data they have gathered on their data sheets.

All students participate in manually separating recyclables on a simulated conveyor belt to show how a materials recovery facility works.

## LESSON 9: BUYING RECYCLED PRODUCTS

### Lesson's concept:

Purchasing and using materials made from recycled products instead of nonrecycled products conserves natural resources.

In Lesson 9 students will:

- Discuss what types of materials can be made from recycled products.
- Compare the properties of paper towels made from recycled fibers to those made from nonrecycled fibers and design a chart to summarize their findings.
- Identify five items in their homes that are made from recycled materials.
- Conduct an informal survey to find out why people do not buy more products made from recycled materials.
- Work in groups to investigate the differences between white paper made from recycled and nonrecycled fibers and the differences between plastics made from recycled materials and nonrecycled materials.
- Design or invent an item that can be made from recycled materials.
- Present arguments about why recycled paper and other products made from recycled materials should be bought and used.
- Describe how to “close the loop” in the use of paper.
- Design an advertisement for a product made from recycled materials.

## LESSON 10: WHAT ARE WE REUSING AND RECYCLING AT SCHOOL?

### Lesson's concept:

Some school waste can be reused or recycled.

In Lesson 10 students will:

- Conduct an audit by using a questionnaire and other methods of gathering data to determine what waste is being generated, what is being thrown away, what currently is being reused or recycled, and what could be reused or recycled at their school.
- Identify ways to make the existing reusing and recycling program more effective at school, or design a plan to start reusing or recycling at least one type of material if there is no reusing or recycling program at their school.

- Analyze the way their trash is handled at home, apply some of the waste minimization concepts and strategies learned at school in the home, and share what they learned with the class.

## LESSON 11: A CLASS OR SCHOOL GAME AND REUSE DAY

### Lesson's concept:

Reusing materials helps to conserve natural resources and landfill space.

In Lesson 11 students will:

- Name organizations and events that facilitate the reuse of old items.
- Work in groups to develop a game out of discarded materials.
- Participate in an auction in which items brought to class by students are auctioned off.
- Organize a class or school "Game and Reuse Day" when games made out of discarded materials will be played and reusable books and toys brought by students will be won, bartered, sold, or exchanged.

## LESSON 12: SHARING WHAT WE KNOW ABOUT REDUCING, REUSING, AND RECYCLING

### Lesson's concept:

Showing and teaching others about reducing, reusing, recycling, and buying products made from recycled materials reinforce what students have learned and encourage others to participate in waste management.

In Lesson 12 students will:

- Work in groups to plan and complete a project, such as a display, newsletter, slogan, skit, or story, that will teach others about reducing, reusing, and recycling materials or that will encourage people to buy products made from recycled materials.
- Design a rubric to evaluate their projects.
- Present their projects to the class and decide which projects should be shared with the entire school.

## Required Books to Implement Unit 2

### • For Lesson 3

Gibbons, Gail. *Recycle! A Handbook for Kids*. New York: Little, Brown and Company, 1992.

### • For Lesson 5

Seuss, Dr. *The Lorax*. New York: Random House, Inc., 1971.

### • For Lesson 6

Williams, Karen Lynn. Illustrated by Catherine Stock. *Galimoto*. New York: William Morrow & Company, Inc., 1990.

## PROJECTS

Projects provide experiences in service learning and project-based learning to students and allow them to apply what they have learned in the classroom. Some lessons in this unit (e.g., lessons 2, 11, and 12) are project-based, and others include parts that are project-based (e.g., lessons 6, 7, and 10).

The following describe projects that students can do in a small group or as a class. Students are encouraged to select one of these projects, or they can develop one of their own. Examples are provided of schools that have conducted projects that address this unit on reducing, reusing, and recycling. If your students implement an applicable project, please send a description of the project to the California Integrated Waste Management Board, Office of Integrated Education, MS-14A, P.O. Box 4025, Sacramento, CA 95812-4025.

- **Project 1:** Students develop a classroom reducing, reusing, and recycling program. (Lesson 2)

### *Bullis-Purissima Elementary School, Los Altos Elementary School District<sup>1</sup>*

*Students from Bullis-Purissima Elementary School created a questionnaire based on recycling. The focus of the questionnaire was to learn how often (always, sometimes, or never) families recycle at home. The survey was then sent home with each student. The information collected was then compiled into a database*

<sup>1</sup>"Jiminy Cricket's Environmental Heroes 1994-97." Burbank, Calif.: The Walt Disney Company, Inc., and the State of California's Environmental Education Interagency Network, 1999, p. 40.

and recorded on graphs. A graph was given to each classroom to demonstrate exactly where that specific class could improve on recycling efforts. Posters were hung in front of the school to remind students and passersby to respect the Earth by recycling.

- **Project 2:** Students set up recycling bins in areas that do not have one; this could be at school or in a nearby park. (Lesson 3)

#### **Redway Elementary School, Southern Humboldt Joint Unified School District<sup>2</sup>**

Jane Rowland, a Redway Elementary School fifth-grade teacher, and her class went on a camping trip and noticed that there were no recycling bins in their local state park. They decided to conduct a fund-raising project to purchase recycling bins for the park. One of the things that the students decided to do was to organize a coloring contest. The winning drawings were compiled in the "Redway School—Help the Earth Blossom" coloring book. They acquired donations for the printing of the coloring book and for posters to advertise the sale of the books. The books were sold by students and by local shops, businesses, and organizations. The class goal was to raise \$200, but they were able to raise over \$400 and purchased the recycling bins for their local state park.

- **Project 3:** Students make toys out of reused materials to give to younger students. (Lesson 6)
- **Project 4:** Students encourage school officials to buy recycled products for the school. (Lesson 9)

#### **The Palo Alto Unified School District<sup>3</sup>**

The Palo Alto Unified School District (PAUSD), with assistance from the City of Palo Alto, launched a new and expanded district-wide recycling program for elementary schools during April's Earth Day Week. Although some schools have been recycling some materials for many years, this new program provides the district with the opportunity to recycle additional materials, reduce garbage costs, and model waste reduction behaviors to PAUSD students. The recycling team consisted of parents, volunteering as recycling coordinators; students, acting as "Recycling Leaders"; the PAUSD Business office; and the City of Palo Alto Recycling Program staff. Parent volunteers donated their time to organize the logistics of their school's program, kickoff events, and a stu-

dent "Recycling Team," which helps monitor lunch area recycling. PAUSD Business Office staff wrote a revised school recycling policy requiring each school to recycle aluminum cans, glass, white paper, and colored paper, and to increase the purchase of school supplies made with postconsumer content. This policy was then approved by the school board.

- **Project 5:** Students select one item on the list of what students could do to reduce waste at school and develop a plan on how to implement it. (Lesson 10)
- **Project 6:** Students find out what the school is recycling and determine what else can be recycled or how the materials now being recycled could be recycled more efficiently. (Lesson 10)

#### **McKinley Elementary School, Stockton Unified School District<sup>4</sup>**

Ms. Rivera's fifth-grade class took control of the existing school recycling program and brainstormed ways to improve it. They determined that recycle bin visibility and program knowledge needed to be increased. The class developed new signs for the recycle bins and promoted awareness of the recycling program through a letter-writing campaign and by writing articles for the school paper.

#### **John Tyler Elementary School, Stockton Unified School District<sup>5</sup>**

Students at the John Tyler Elementary School practice throughout their lives to reduce, reuse, and recycle, whether they are at school, home, or even on a field trip. Students participate in the C.L.E.A.N. squad, which is an acronym for Children Learning Environmental Awareness Naturally. The C.L.E.A.N. squad collects anything that can be recycled. They have rolling trash cans to collect recyclables throughout the school and have made use of an empty classroom as their recycling center where everything is sorted, weighed, recorded, and broken down.

- **Project 7:** If there is no recycling program at school, students organize a recycling program, emphasizing collection and recycling of aluminum and paper. (Lesson 10)

<sup>2</sup>"Jiminy Cricket's Environmentality Heroes 1994-97." Burbank, Calif.: The Walt Disney Company, Inc., and the State of California's Environmental Education Interagency Network, 1999, pp. 34-35.

<sup>3</sup>"For Palo Alto, Recycling Is Elementary!" *Reusable News*. Sacramento: Integrated Waste Management Board (fall, 1995).

<sup>4</sup>"Jiminy Cricket's 1997-98 Environmentality Winners." E-mail from Deidra Bennett, Senior Environmental Programs Representative, Environmental Policy, The Walt Disney Company, Inc., October 15, 1998.

<sup>5</sup>"Jiminy Cricket's Environmentality Heroes 1994-97." Burbank, Calif.: The Walt Disney Company, Inc., and the State of California's Environmental Education Interagency Network, 1999, p. 39.

### **Gold Trail Union Elementary School District, El Dorado County<sup>6</sup>**

Gold Trail Union Elementary School District in El Dorado County has been “doing the right thing” for a very long time. Beginning in 1985, paper has been collected for recycling from the two schools in the district. More Paper Recycling, a nonprofit organization dedicated to providing jobs and training to developmentally disabled adults and children, picks up mixed and white paper for recycling. The students maintain the recycling bins and do the sorting. In 1992 the district expanded its recycling program by working out an agreement with the vendor to recycle cardboard. The schools in the district also have a composting program. (Composting is a type of recycling; see Unit 3.)

### **Wilson Elementary School, Dinuba Elementary School District<sup>7</sup>**

The entire school population works at recycling soda cans for “Reading Is Fundamental.” The money is used to buy books for students. As a result, each student at Wilson Elementary School receives three “free” books a year.

- **Project 8:** Students organize a conservation and recycling fair to provide information on recycling and entertainment for the community. (Lesson 11)

### **John Malcolm Elementary School, Capistrano Unified School District<sup>8</sup>**

The “Barney Bunch,” a group of students from John Malcolm Elementary School, formed a partnership with a local disposal company to begin an extensive recycling program at school. They culminated their efforts with Earth Summit II, a Conservation and Recycling Fair featuring over 22 booths, exhibits, and displays, as well as characters such as Mother Earth, Ricky the Raindrop, Recycle Rex, and Mr. Pollution. Over 2,000 heard their message!

### **Isador Cohen Elementary School, Sacramento City Unified School District, in Partnership with the California Integrated Waste Management Board**

The California Integrated Waste Management Board (CIWMB) sponsored the Second Chance Week dur-

ing the period of October 18–26, 1997. The activities the staff from CIWMB organized in partnership with staff and students at its adopted school, Isador Cohen Elementary School, included a school-wide book exchange, book repair clinic, and art from a scrap workshop. Students also presented the results of the event and samples of their artwork at a public meeting of the CIWMB.

The Second Chance Week is designed to promote the concepts of reuse, repair, and resale. For more information see the following website: <http://www.secondhand.com>.

- **Project 9:** Students develop a holiday display (Thanksgiving, New Year’s Day, Valentine’s Day, Fourth of July) to raise awareness about waste during the holidays and how to reduce it. (Lesson 12)
- **Project 10:** Students develop and implement ways to educate others about the benefits of recycling through slogans and logos, posters, displays, radio announcements, newsletters, poems or songs, skit or plays, stories, and bulletin boards. (Entire Lesson 12)

### **McKinley Elementary School, Stockton Unified School District<sup>9</sup>**

Ms. Rivera’s class focused on developing and promoting environmental awareness at the McKinley Elementary School. They participated in an educational program sponsored by their local waste disposal company. The club, Yakkety Yak! Recycle That! encourages students to take a leadership role in their school’s recycling program. The goal of the club is to educate others about the benefits of recycling through skits, plays, art projects, essays, presentations, and fairs. Ms. Rivera’s class educated their fellow students through a school-wide essay and poster contest based on the theme of cutting down on trash. The class with the highest number of entries was treated to an ice cream party.

**Note:** To acquire a copy of “Jiminy Cricket’s Environmentality Heroes 1994–97,” contact the California Integrated Waste Management Board’s Office of Integrated Education at (916) 341-6769.

For ideas for awards and projects, see “Appendix F–I, Awards and Activities websites.”

<sup>6</sup>“Gold Trail Union Elementary Does It Right!,” *Reusable News*. Sacramento: California Integrated Waste Management Board (spring, 1995).

<sup>7</sup>Submitted by Janell Olson, fourth-grade teacher and field tester for *Closing the Loop*, Wilson Elementary School, Dinuba Elementary School District.

<sup>8</sup>“Jiminy Cricket’s Environmentality Heroes 1994–97.” Burbank, Calif.: The Walt Disney Company, Inc., and the State of California’s Environmental Education Interagency Network, 1999, p. 31.

<sup>9</sup>“Jiminy Cricket’s 1997–98 Environmentality Winners.” E-mail from Deidra Bennett, Senior Environmental Programs Representative, Environmental Policy, The Walt Disney Company, Inc., October 15, 1998.

# LESSON 1: Sources of Energy

## LESSON'S CONCEPTS

- Energy is the ability or capacity for doing work by a body or system, and energy is required for any change to take place. The word *energy* can also describe resources used for producing power; e.g., solar energy, fossil fuel energy.
- Various sources of energy are used to make a variety of objects and to provide power to operate certain objects.

### PURPOSE

Students will be introduced to the ways people use sources of energy. They will also be taught how to identify the connections among a purchased object, the use of energy sources to make and possibly use this object, and the waste of energy sources when the object is placed in a landfill.

**Note:** It is not the intent of this lesson to teach students about units of energy, forms of energy, or transformation of energy. For those topics, science textbooks should be consulted.

### OVERVIEW

In this lesson students will:

- Define the word energy.
- Identify the sources of energy people use to make and operate various objects and determine which of these are considered renewable or nonrenewable.
- Determine what things they enjoy doing that requires using objects and identify the energy sources and other natural resources used to make or to use these objects.
- Develop a game to teach others about energy sources and other natural resources and the importance of conserving them.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students identify the sources of energy people use to make and operate various objects and determine which of these are renewable and nonrenewable.

- "Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation." (*Science Content Standards, Grades K–12; Grade 6; Resources, Standard 6*)
- "... students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and classify them as renewable or nonrenewable." (*Science Content Standards, Grades K–12; Grade 6; Resources, Standard 6b*)
- "... students know the natural origin of the materials used to make common objects." (*Science Content Standards, Grades K–12; Grade 6; Resources, Standard 6c*)
- Students write directions to the games they invent about energy sources and other natural resources.
  - Students "use traditional structures for conveying information (e.g., chronological order, cause and effect, similarity and difference, and posing and answering a question)." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 23*)
  - Students "choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 37*)



## SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, applying

## TIME

30 minutes to prepare for the lesson; approximately 90–120 minutes to complete the

lesson (Additional time might be required for students to complete the games they are designing.)

## VOCABULARY

energy, energy sources

## PREPARATION

- Read the “Background Information for the Teacher” at the end of this lesson.

## MATERIALS

- Several dictionaries
- Piece of butcher paper on which to record students’ answers
- Materials for students to create games, such as playing cards and reused items from which to make board games

## PRE-ACTIVITY QUESTIONS

- Ask students what is *energy*? They can look up the word in a dictionary. As a class (or in small groups) have students develop a definition. *Energy is the ability or capacity for doing work by a body or system. Energy is required for any change to take place. It takes energy to make things. The word energy can also describe resources used for producing power; e.g., energy sources, solar energy, fossil fuel energy.*
- Discuss with students what sources of energy are found on Earth. *Fossil fuels (petroleum, coal, natural gas); sun (solar energy); wind power; hydropower; geothermal energy; and tidal energy.* (Students might not know all of these at this time.) Write students’ answers on a piece of butcher paper and keep the list to use at the end of the lesson.
- Ask students what things they enjoy in life that require energy to make or to use (e.g., computer or television set needs electricity; energy was needed to manufacture the different parts). Develop a list of these things with the class and display the list during this lesson.

## PROCEDURE

- Ask students:
  - How else are energy sources used by people, other than for making things? *For*

*transporting things, heating, and generating electricity.*

- Think of all the things we use electricity for. Where does the energy for generating electricity come from? *From energy sources, such as fossil fuels, hydropower, wind and solar energy.* (Students might not know this at this time.)
- Explain to students that just as plants are considered to be renewable, natural resources and most minerals are nonrenewable natural resources (studied in the 4–6 Module, Unit 1, Lesson 4); there are renewable energy sources and nonrenewable energy sources. Write the following words on the chalkboard: solar, wind, oil, coal, natural gas. Ask students which of these do they think are renewable energy sources (solar, wind) and which are nonrenewable (oil, coal, natural gas) and to explain why.
  - Ask students to select something they really like to do that requires the use of some type of object or objects. They can get ideas from the list developed in “Pre-Activity Questions” C. They should:
    - List all the objects they need to do this activity.
    - Get into groups with similar interests.
    - As a group, identify and compile lists of energy sources and other natural resources used to make the objects used in the activity and include:
      - The natural resources probably used to manufacture the object (Do not forget to include air and water.)
      - The possible negative impacts to the environment when energy sources and other natural resources are extracted from the Earth
    - Develop a way to show the rest of the class what energy sources and natural resources are needed for the selected

activity. For example, use illustrations, cutouts from magazines, charts, or other visuals.

**D.** Have groups report to the class.

- Have the class identify what renewable and nonrenewable energy sources and other natural resources are used in each selected activity.
- Discuss with students that minerals are considered nonrenewable natural resources (but they can be made to last a long time if they are recycled).
- Discuss with students what will happen to the objects used in their activities when they break or when students no longer want them. How can they be made to last or be prevented from going to a landfill? *They can be reused, repaired, or recycled.*

**E.** Have groups assume that a natural disaster eliminated the energy source and other natural resources needed for their activity. Discuss what their options would be (e.g., try to make their things last as long as possible; then look for alternatives to the items they need.)

**Homework Assignment:** Ask students to find out some things that a member of their family likes to do that requires the use of some type of object and to list the energy sources and other natural resources needed to do this activity.

**F.** Ask students to share their homework assignment. Discuss what activities require minimum props (or objects).

## DISCUSSION/QUESTIONS

Discuss with students:

- Why should we care about conserving natural resources and energy? *Because we could run out of nonrenewable energy sources and would not be able to have things we like, live the way we do now, or be able to live the way we want to.*
- If you know that there are only so many nonrenewable energy sources, such as fossil fuels, what decisions can you make to keep those resources lasting for your lifetime and your children's lifetime? *I would conserve electricity and not buy things that would be thrown away right away.*
- In what ways is energy tied up in waste? *In acquiring the raw materials; in using energy for the manufacturing and transporting of products.*

- How does placing an object in a landfill waste energy sources? *It took energy to make it and to transport it. In a landfill it can no longer be used. New resources will be needed to make a new object (unless recycled materials are used).*
- How does what we have learned in this lesson apply to our everyday lives?

## APPLICATION

- A.** Ask students to look at the definition of *energy* that they developed at the beginning of this lesson and decide whether anything should be changed. Then ask students to look at the sources of energy found on Earth that they listed at the beginning of the lesson and see whether they want to make any changes.
- B.** Brainstorm some ideas for games that could teach others about nonrenewable energy sources and other natural resources and the importance of conserving them.
- C.** Tell groups of students that they will be asked to design a game to teach others about nonrenewable energy sources and other natural resources and the importance of conserving them. Students might need to do some research first. For example, they can invite a speaker from a local utility company to discuss what energy sources are used to provide power to their community. They can also find out the consequences to the environment (e.g., air, land, and water pollution) of converting energy sources into electricity. They can do this by doing research in science textbooks and on the internet.
- D.** Groups of students should first decide on the focus of their game. Then each group will need to determine what type of game it will design. Some examples are provided below. Students should write, or input on the computer, the rules or guidelines to the game that they design.
1. Students can develop a card game. One idea is described below:
    - Use a standard deck of cards. A suit represents one nonrenewable energy source (e.g., spades represent petroleum; clubs, coal; diamonds, natural gas).
    - Hearts are used as trump or award cards; the numbered cards represent people conserving energy; and the

jack, queen, king, and ace represent people wasting energy sources.

- Each number on a card represents energy units.
- The object of the game is to be the player left with the most units of energy.
- Determine a way to select who will be the dealer; then all other players will play in a clockwise direction. For the next round, the player next to the dealer's left will take the role of the dealer.
- Six cards are distributed to each of four to six players by the dealer. The remaining cards are placed face down. The dealer turns one card face up, and that is the suit that all players must follow. The game is played by having each player lay down a card of the same suit, and the player who plays the card with the smallest number (units of energy) collects all cards played and can use them for future play. If a player does not have a card of the suit being played, he or she can use a heart suit. If the player does not have a heart suit, then the player draws one card from the face-down pile. If the player cannot play the card drawn, the next player tries to play a card.
- If no players have the suit of the face-up card, and each has drawn one card

that each cannot play, then the face-up card goes to the dead pile and another card is drawn by the dealer of the round.

- If during the beginning of a round the first player turns up a heart from the deck, the player keeps the heart and turns up another card. The player may continue to keep any upturned hearts until another suit is placed face up from the deck.
  - A heart face card or ace can be played to beat all other suits, but once it is played, all the played cards (including the face card) go into a dead pile and can no longer be played. The numbered heart cards are wild cards and can be played if a player does not have a suit that is in play.
  - The player wins the round if the card he or she plays is the smallest numbered card in play.
  - When a round is over, another card is placed face up from the face-down pile.
  - Students will need to develop additional rules, as needed, to make the game work to their satisfaction.
2. Students can design a video game. They can use an existing video game and change the players in the game into those who are conserving energy

Picture intentionally deleted.

Students in Barbara Cronin Hershberg's fourth-grade class at Hollister Elementary School play a card game about sources of energy.

sources and those who waste energy sources. They can also design a new game.

3. Students can develop a simulation game.

- For example, the simulation is that they are on a desert island and have only a certain number of energy sources and other natural resources available for their use.
- They will need to write a scenario of the situation and then describe how they will make certain of surviving for many years (or their entire lives).
- They can have various students be experts on the island (e.g., solid waste manager, energy manager, natural resource manager, personnel manager, manager of the manufacturing of products, manager of air and water quality, manager of the group's choice). The plan for living on the island would be developed on the recommendations of each of the experts.
- The scenario can then be shared with other groups, who can describe how they would make certain of surviving.
- The different ways to survive on this island can be compared and discussed.

4. Students can make a board game. Dice or spinners can be used to move a player on the game board. All items in this game should be made from reused materials (e.g., large dice can be made from two milk cartons cut and fitted into each other to make a square; reused paper can be glued on the milk cartons, and the numbers of the dice can then be drawn).

- E. Have students share their games and allow time for groups to play some of these. Ask the class to determine what main ideas or concepts each game is teaching about the sources of energy and other natural resources and the importance of conserving them.

## EXTENSION

- A. Have students determine how these games can be shared with other classes. Allow students to do so.
- B. Have students find out whether there are any manufacturing companies in their community. If so, students can do research to find answers to the following questions:
- What products do these companies make?
  - Where do they get the raw materials to make the products?

Picture intentionally deleted.

Students from Janet Cohen's sixth-grade class at Gold Trail Elementary School design a game about conserving natural resources.

# BACKGROUND INFORMATION FOR THE TEACHER

- What are their major sources of energy to operate the manufacturing plant and to make the products?

Humans use sources of energy in many ways; e.g., for heating and cooling buildings, generating electricity, powering vehicles and other machines, and manufacturing products. Unfortunately, almost all sources of energy used by people produce some type of waste, which could pollute air, water, or soil.

The concept of energy can be difficult for your students to comprehend. You could explain that energy is the ability or capacity for doing work by a body or system. Anytime a person walks, a rock falls, a river flows, or a machine moves, energy is being used. When energy is being used, we observe or sense light, heat, or motion.

Energy is also the essential force behind change. That is, in order for any change to happen, energy must be used; for example, aluminum being melted, products being shipped from one place to another, a tree growing.

The word *energy* also describes resources used for producing power. These energy sources include fossil fuels, solar energy, wind power, hy-

dropower, geothermal energy, and tidal energy.

Fossil fuels include crude oil, coal, and natural gas. Humans use fossil fuels as a source of energy to generate electricity or move machinery. The entire transportation system is dependent on petroleum products. Humans use petroleum and natural gas to make plastics from which many items are manufactured. Petroleum is also used in making many commonly used products, such as fertilizers, lubricating fluids, cosmetics, and pesticides. Fossil fuels are nonrenewable resources because they are finite and take a great length of time to form.

People depend on sunlight to provide energy for plants to live and grow. People depend on plants for food, fiber, building materials, and fuel.

Solar energy is also used to heat homes and to produce electricity. Solar energy is a renewable resource because it is available whenever the sun shines and will continue to be available as long as the sun exists.

Additional information on energy sources is provided in the 4–6 Module, Unit 1, Lesson 1,

# LESSON 2: Performing a Class Audit of Waste

## LESSON'S CONCEPT

Analyzing the source and content of a waste stream is the first step in learning how to reduce, reuse, and recycle.

### PURPOSE

Students will learn what types of garbage are generated in the classroom and develop strategies to lessen the amount of the classroom garbage they produce through reducing, reusing, and recycling.

### OVERVIEW

In this lesson students will:

- Observe the amount of waste generated by the class.
- Categorize the waste from their classroom by type of material from which products were made, and analyze each category by weight, volume, and number of items.
- Calculate the percent of waste by type of material and determine how much waste is generated by the class in one day, one month, and one year.
- Attempt to reduce the amount of waste they dispose of in the class's garbage can over a one-week period and complete charts to show their progress.
- Design a plan to reduce in the classroom the amount of waste that would have been placed in a landfill.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Individually and in teams, students collect, sort, and record on a chart information about waste generated by the class. They classify the items of waste according to the material from which each item was made.
  - "Students will: classify objects . . . based on appropriate criteria." (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 5a*)

- Students calculate the percent of waste by type of material and determine how much waste is generated by the class in one day, one month, and one year.
  - Students "calculate given percentages of quantities . . ." (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 24*)
- Students participate in discussions about ways to lessen the amount of waste that the class generates and sends to a landfill. Students are challenged to support opinions, ask questions, and make other contributions to the group.
  - "Students listen critically and respond appropriately to oral communication. They speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 26*)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, applying

### TIME

30 minutes to prepare for the lesson; approximately 45–60 minutes per day for five days (Monday through Friday) to implement the lesson

### VOCABULARY

reduce, reuse, recycle, solid waste, waste stream

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. Find out which materials are recycled in your community. (Contact the city or county recycling coordinator or the local garbage/recycling company. Ask if you can be sent a class set of brochures indicating which materials are recycled in your community. Students can take these home to their families. Also ask for a directory of recyclers in the community. This allows families without curbside recycling programs to find drop-off centers for their recyclables. Note that the materials that are recycled may vary from community to community.)
- 3. On Monday ask the custodian not to empty your class’s waste basket. You can also place the waste in a large plastic bag, label it, and make sure that the custodian does not throw it away. Your class will analyze this waste on Tuesday.

**Note:** Before the class analyzes the trash in the classroom, make sure that the trash is clean. If needed, wash jars and cans and place food trash in a sealed transparent container. Also, remove any potentially hazardous substances or private notes (that students might not wish to be read by others).

- 4. Make transparencies of the four charts of “Class Waste Analysis” (pages 329 and 330). Duplicate the “Class Waste Analysis, Wednesday’s Waste,” for each group of three to four students.

## MATERIALS

- The waste generated in your classroom on Monday for class on Tuesday; the waste generated on Tuesday for class on Wednesday; the waste generated on Wednesday for class on Thursday, and the waste generated on Thursday for class on Friday
- A scale for weighing waste materials
- Six to ten grocery-size paper bags in which the waste can be separated
- Washable plastic or cloth tarp
- Kitchen gloves for students (about six pairs)

## PRE-ACTIVITY QUESTIONS

### Monday Afternoon (Day 1)

- A. Do not tell students that you will be collecting and they will be analyzing the classroom waste that they generated today. But do ask students to use the classroom’s waste basket for everything they throw out today (including items from lunch).
- B. Record students’ estimates to the following questions. At the conclusion of the lesson, you will compare these figures with those of the actual audit of classroom waste.
  - How many times do you drop something in the garbage can at school each day?
  - How much waste do you think you generate in one school day? Record students’ estimates in number of pieces of waste (e.g., five pieces of paper, one soda can) and by weight (e.g., one pound or 454 grams).

**Note:** You might want to find an item that weighs approximately one pound and allow students to hold it to get a feel for the weight of one pound.

- How much waste do you think the whole class generates in one day? (Have students estimate by pieces of waste and by weight.)
- C. Ask students to record in their journals the kinds of things they threw away today at school and where they threw them.
- D. Encourage students to share their journal entries with the class.
- E. Ask students:
  - Can you think of any examples of how the class currently reduces or reuses classroom waste? *We use both sides of paper.*
  - Do you know whether our school has a recycling program? If yes, have students discuss the types of materials which are collected in the program. If they are not certain, ask student volunteers to find out and to report their findings to the class.

## PROCEDURE

### Tuesday Afternoon (Day 2)

- A. Share with students the following story:

A private investigator has been hired by a class in another school to find out what we have been doing in the classroom. It seems

that we have been seen participating in activities that looked entertaining.

The private investigator decided that one way to find out about our class's activities was to check our garbage can at the end of the day. What could he find out by looking at our classroom's waste? For instance, could he find out what kind of lessons you have been working on? Whether you have been working on any arts and crafts projects? Can he find out whether food is allowed to be eaten in class and, if so, what kinds of food have been eaten? He is planning to look through our garbage can at the end of every day for one week, but he does not know that we know what he is going to do.

The private investigator went through all of our class's waste on Monday and recorded everything he found. He then returned the garbage and here it is.

- B. How much waste do you think our class generated yesterday (in numbers of items, and/or pounds, or number of bags)? Write students' guesses on the chalkboard.
- C. Spread a plastic or cloth tarp on the classroom floor and dump (clean) classroom waste on the tarp.
  1. Tell students that they will analyze the garbage that they generated yesterday.
  2. Ask students to identify several categories, by type of material from which the waste items were made (e.g., paper, glass, aluminum), and list the categories on the chalkboard.
    - Project the "Class Waste Analysis, Monday's Waste" and add categories that are listed on the chart but not listed on the chalkboard.
    - Put away the "Class Waste Analysis" chart until step #5.
  3. Select several students to be the waste separators and provide them with gloves to sift through the classroom waste. Students should place items in piles, by category.
  4. Have the rest of the students observe the separation of the waste and recommend which items should go into which pile.
  5. Have students count the pieces of trash from each category and record these on the chart, "Class Waste Analysis,

Picture intentionally deleted.

Students from Janet Cohen's sixth-grade class at Gold Trail Elementary School separate the classroom's waste into categories.

Monday's Waste," projected on the overhead.

- Ask students to identify the largest waste category or categories.
- Have students total the number of pieces of waste and write this number in the last column on the chart.

**Note:** Younger students can skip the following calculations for percent.

- Help students to calculate the percent for each type of waste. This is done by dividing the number of a waste type by the total number for all types of waste. For example, if the class counted 40 pieces of paper and the total number of waste pieces was 80, then the percent of paper is calculated by dividing 40 by 80, which equals .50 or 50 percent. Therefore, 50 percent of the classroom waste was paper.
6. Place each category of waste into a separate grocery bag, label the bag, and weigh it. Weigh an empty bag and subtract the weight of the empty bag from the weight of the bag with the waste. Record the weight of the waste (without the bag) on the chart. Add up the total weight for all waste. Calculate the percent of each waste type, by weight.
  7. Have students calculate the volume of the waste. For younger students, have



them approximate what portion of the bag (or how many bags) the waste occupies; for older students, mold the bag over the waste so students can measure the width, length, and depth of the trash. **Note:** Because in a landfill the garbage is compacted, students might consider ways to compact the garbage before calculating its volume. Make certain that students do this in a safe manner. Write the results on the chart.

8. Discuss with students:

- What does the chart tell us about our class's waste? Approximately what percent (or portion of all the waste) was paper? glass? aluminum? other metal? plastic? food items?
- Did every piece of waste have to be thrown away? Is there anything that could have been used again? What waste could have been reduced? *Excess packaging, paper napkins, disposable eating utensils, paper that can be reused*
- What could have been reused? (Accept all answers at this time.)
- What could have been recycled? (Accept all answers at this time.)

**Note:** Students might not yet know what can and cannot be recycled in their community or school. They will find this out in "Procedure" section "G."

- Is the paper we collected in one of the grocery bags being used on both sides or is the paper being wasted? In what ways could we generate less paper that ends up in the trash can?
  - If the waste is in the trash can and it is not retrieved, where does it go? *To the landfill.*
  - Are we careful about conserving items in this class or careless about what we are throwing away?
  - What would you do if there was no trash can to throw these items into?
9. Write "landfill" in large letters on the classroom trash can (or on a piece of paper taped to the trash can).
10. Have students suppose that they produce the same amount of waste daily as they did on Monday.

- Ask them to calculate how much waste, by weight, their class would generate each month (amount of trash generated on Monday times 20) and how much in one school year (times 180 or whatever the total is for your district).
- Students could also find out how many classrooms there are in their school and school district and calculate an approximate amount of waste their school and all other schools in their school district produce each day, each month, and each school year.
- Discuss how students can lower these figures.

**Homework Assignment:** Ask students to write up the report that the private investigator might have written. Students should describe the day's activities in the classroom, based on clues in the trash can. Ask them to copy what was found in the waste and to write the private investigator's report at home.

- C. Challenge students to generate less waste today (Tuesday). Tell students: "We don't want the private investigator to find out what we did today, but you cannot throw your trash in a trash can outside our classroom. The private investigator will see that waste and might get suspicious that we know that he is looking in our garbage."
- D. Discuss illegal dumping. Illegal dumping happens in all communities when people place garbage in someone else's garbage can or dumpster or throw the garbage in a nondesignated disposal site, such as on a roadside, in an empty lot, in a creek, or in a park.

### Wednesday (Day 3)

- E. Analyze Tuesday's waste on Wednesday morning.
- Select a new group of students to be the waste separators and provide them with gloves for this task.
  - Using an overhead projector, project the transparency "Class Waste Analysis, Tuesday's Waste" and have students complete it.
  - Challenge students to reduce the amount of waste they place in the garbage can that day and analyze the waste on Thursday.

## Thursday (Day 4)

- F. Separate the class into groups of three to five students and provide each group with the chart, “Class Waste Analysis, Wednesday’s Waste.”
- Ask groups to complete their charts.
  - Compare the results among all the groups and record the results on the chart on the overhead transparency.
  - Ask students to reduce the amount of waste they place in the garbage can today for tomorrow’s analysis.

## Friday (Day 5)

- G. On Friday determine how much waste was generated on Thursday. Use the transparency “Class Waste Analysis, Thursday’s Waste” and complete the chart with your class. How did the amounts compare to Tuesday’s analysis?
- H. Consider designing a graph or a series of graphs to summarize the data on the charts.
- I. If available, provide students with brochures indicating which materials are recycled in your community. This information can usually be acquired from a local solid waste company or from the city or county’s solid waste department.
- If brochures are not available, one student could call the local solid waste company or the city’s or county’s solid waste department to obtain the information.
  - Discuss with your class the types of recycling your community offers. (You may find that in smaller communities, the availability of many different kinds of recycling is limited.)

**Note:** In the 4–6 Module, Unit 2, Lesson 3, students will learn about the difference between reusing and recycling.

**Homework Assignment:** Ask students to prepare a written list of the kinds of items in their homes and class which can be recycled.

- J. Have students share and compare their lists.

## DISCUSSION/QUESTIONS

- A. Ask students:
- What would the private investigator have learned about us, based on the

garbage we generated on Monday? What did he learn about us, based on Thursday’s garbage?

- How does our garbage provide clues about our habits?
  - What was the difference in the waste we collected on Monday compared to the waste we collected on Thursday?
  - Did we reduce the amount of waste that went into the trash can? By how much? Was it easy to do? Why or why not?
- B. Compare the actual waste figures to the students’ estimates at the beginning of the lesson. Ask for students’ comments and insights.
- C. Based on our observations of Tuesday’s waste, what materials that were thrown away could have been reused? List these. What are some easy ways to get reusable items back into use? *Wash them; fix them; give them to someone who wants them.*
- D. Based on our observations of Tuesday’s waste, what materials that were thrown away could have been recycled? List these. *Paper, aluminum*
- E. Discuss with students:
- What did the private investigator hired by another class probably tell that class about this lesson? What types of garbage might he find at the end of this lesson?
  - What did we reuse? What did we recycle?
  - What type of garbage do you usually throw away at home?
  - What would a *garbologist* (person who studies garbage) learn about your household? What did we reduce?
  - What is one way that scientists can find out about people who lived in the past? *They can look through their garbage.*
  - Archaeologists who study garbage left by people in the past can often determine how the people lived, what they ate, and what they valued. What types of garbage would you expect people who lived in this area 100 years ago to have? What types of garbage would you expect people who lived in this area 500 years ago to have?

- How would the garbage from past civilizations be different from our garbage?

## APPLICATION

- A. Ask students what is solid waste and what they have learned that might help us to manage solid waste in our classroom.
- Discuss the ways that students could generate less waste in their classroom.
  - Brainstorm with the class a list of solid waste reduction actions or tips. For example, what are good ways to save paper? Some ideas are listed below:
    - Always use a sheet of paper on both sides before putting it in the recycling bin.
    - Cut up paper used on one side and use it for memos and notes.
    - Make double-sided copies whenever possible.
    - Photocopy or print draft documents on the back of paper that has already been used on one side.
    - Save scraps of colored paper for cut-and-paste activities or other art projects.
    - Do not waste paper towels or paper cups.
- B. Introduce to or review with students the waste management hierarchy listed below. Explain to students that because of the energy savings and the amount of natural resources conserved, this hierarchy serves as a way of setting up priorities for dealing with our waste.
- Waste prevention (also called source reduction) (reducing and reusing)
  - Recycling and composting (including buying products made from recycled materials)
  - Environmentally safe (nonpolluting) incineration (burning waste-to-energy) and environmentally safe land disposal (landfilling) practices (that conserve and protect the quality of the environment).
- C. Ask students to look at the journal entry that they completed in the “Pre-Activity

Questions” section “C.”

- Have them check items that they threw away today or yesterday that did not have to be thrown away.
  - Discuss what could be done with these items, based on the waste management hierarchy.
  - Ask students to circle the items they threw away that could be reused, underline those that can be reused, and place a star next to those that can be recycled in their school (if applicable) or in their community.
- D. Do one or more of the following:
1. Have students design a plan to reduce the waste in the classroom that needs to be thrown away. They can design containers for those items that can be reused or recycled. These containers can simply be cardboard boxes lined with plastic. These boxes can be decorated by students and clearly labeled.
  2. Challenge students to keep the waste in the classroom’s wastebasket to a minimum. Ask for volunteers to monitor the wastebasket and conduct a class meeting once or twice a month to analyze whether students are continuing to limit the amount of waste that goes into the landfill.
  3. Have students pledge to take one or two waste-reduction actions and record their pledge on a chart. Save this chart and check back with students in a month to see whether they are fulfilling their pledge.

**Note:** The feasibility of recycling will depend on whether the school has a recycling program. If the school does not have a recycling program, an adult volunteer could recycle the materials at a recycling center.

**Project Idea:** Have students develop a classroom reducing, reusing, and recycling program.

## VARIATIONS

Two variations to this lesson are described below:

- A. Instead of conducting the lesson as written, save the waste from the classroom for one week without letting the students know that it is being done, and then have them analyze the waste. You may want to enlist

the maintenance person's help, so that he or she knows that you are not going to need to have your trash picked up for a week (or the maintenance person could save the classroom's waste for a week or a month and store it away from the classroom until you are ready to use it). At the end of the week, ask students to predict how much waste was generated by the class.

- Have students count, analyze, and compile a chart of their findings.
- Discuss with students:
  - How did the actual amount of waste compare with the students' predictions?
  - Why might the predicted figures be lower or higher than the actual count? For example, if the predictions are lower than the actual count, it could mean that students were not aware of all the trash being generated each week and have not implemented the reducing, reusing, and recycling regimen. If the figures are higher than the actual count, then perhaps students were more aware of the solid waste problem and were already reducing, reusing, and recycling waste.

- B.** Have each student bring a plastic garbage bag to school on Monday. Inform students that they must carry in their bags any garbage that they generate during the week.

**Note:** For this activity, you will need to set ground rules. For example, will students add the materials they generate at home as well (making it necessary for them to take their garbage bags to and from school daily or store the garbage in two bags)? Is food waste to be included and, if so, be certain that students do not store the bags in lockers or other areas where vermin, cats, dogs, or other animals might be attracted to the contents. Suggest that students use two or three bags to prevent tearing and spilling.

1. At the end of the week, have students weigh their bags of garbage to see how much garbage they generated. Ask them to classify how much was paper, how much was food waste, and how much was other types of materials. They do not have to weigh these individual components—just estimate the amount or percent.
2. Discuss with students who had the

most and who had the least garbage and who had reusable, recyclable, or compostable materials.

3. Discuss what effect carrying their garbage around for a week had on students. Ask students:
  - Were you surprised by the weight and volume of the garbage you collected? Did it lead you to think more actively of ways to reduce waste?
  - If everyone had to carry his or her garbage all the time, would that person generate less garbage, encourage manufacturers to change the design of products (e.g., less packaging), or modify his or her purchasing habits?
4. Have students determine what they want to do with their garbage (i.e., what materials should be reused, recycled, or placed in a garbage can).

## EXTENSIONS

1. Have students do research on the local penalties for illegal dumping and have them report their findings to the class.
2. Encourage students to take a sequence of photographs over a week's or month's time of an area where people are dumping their trash illegally.

## RESOURCES

### Videos

*Garbage.* Bill Nye the Science Guy series. Elk Grove Village, Ill.: Disney Educational Productions, 1995 (26 minutes).

Part of the video shows how to determine the amount of garbage that is produced after a meal. The waste is separated by types of material and weighed; the results are graphed.

*Recycling: It's Everybody's Job.* Washington, D.C.: National Geographic Society, 1992 (20 minutes).

For a class project, students sort through and separate family garbage to learn why recycling can be part of a solution to our solid waste problem.

### Computer Program

*Too Much Trash?* Computer program and National Geographic Kids Network. (For grades 4–6.) Washington, D.C.: National Geographic Ed-Tech, 1993.

Students design and implement an in-class trash collection system and calculate the average weight of the trash thrown away by each student. The class graphs its findings, shares data with research teammates at another school, and analyzes results with the help of the unit scientist. Students devise, implement, and evaluate a plan to reduce, reuse, and recycle their classroom's trash. To participate in this program, the class has to sign up for an eight-week tuition and telecommunication session offered three times a year.

## **Book**

*Fifty Simple Things Kids Can Do to Recycle*. Prepared by The EarthWorks Group and the California Department of Conservation's Division of Recycling. Illustrated by Michele Montez. Berkeley: EarthWorks Press, 1994.

Describes why students should recycle and how they can recycle.

## **Websites**

See "Appendix F–V, Recycling websites."

# **CLASS WASTE ANALYSIS** **MONDAY'S WASTE (WASTE FROM DAY ONE)**

Type of data	Paper	Glass	Aluminum (cans)	Other metal (cans)	Plastic	Food items	Total
Number of pieces of waste							
Percent of all pieces							
Weight							
Percent of total weight							
Number of bags or portion of bag (volume)							
Percent of all bags							

# **CLASS WASTE ANALYSIS** **TUESDAY'S WASTE (WASTE FROM DAY TWO)**

Type of data	Paper	Glass	Aluminum (cans)	Other metal (cans)	Plastic	Food items	Total
Number of pieces of waste							
Percent of all pieces							
Weight							
Percent of total weight							
Number of bags or portion of bag (volume)							
Percent of all bags							

## CLASS WASTE ANALYSIS

### WEDNESDAY'S WASTE (WASTE FROM DAY THREE)

Type of data	Paper	Glass	Aluminum (cans)	Other metal (cans)	Plastic	Food items	Total
Number of pieces of waste							
Percent of all pieces							
Weight							
Percent of total weight							
Number of bags or portion of bag (volume)							
Percent of all bags							

## CLASS WASTE ANALYSIS

### THURSDAY'S WASTE (WASTE FROM DAY FOUR)

Type of data	Paper	Glass	Aluminum (cans)	Other metal (cans)	Plastic	Food items	Total
Number of pieces of waste							
Percent of all pieces							
Weight							
Percent of total weight							
Number of bags or portion of bag (volume)							
Percent of all bags							

# BACKGROUND INFORMATION FOR THE TEACHER

**Note:** It is recommended that students complete the 4–6 Module, Unit 1 on natural resources to provide them with background on the importance and purpose of reducing, reusing, and recycling waste.

The California Integrated Waste Management Board (CIWMB) is the state agency responsible for protecting the public's health and safety and environment through the effective management of California's solid waste. The CIWMB encourages the conservation tenets of "reduce, reuse, and recycle" needed to reach the state's goal of diverting 50 percent of its solid waste from landfills.

Mandates applying to the management of solid waste in California are described in the Public Resources Code (PRC).

- PRC Section (§) 40051 states: In implementing this division (the California Integrated Waste Management Act of 1989), the Board and local agencies shall do both of the following:
  - (a) Promote the following waste management practices in order of priority:
    - (1) Waste prevention (source reduction).
    - (2) Recycling and composting.
    - (3) Environmentally safe transformation and environmentally safe land disposal, at the discretion of the city or county.
  - (b) Maximize the use of all feasible source reduction, recycling, and composting options in order to reduce the amount of solid waste that must be disposed of by transformation and land disposal. For wastes that cannot feasibly be reduced at their source, recycled, or composted, the local agency may use environmentally safe transformation or environmentally safe land disposal, or both of these practices.
- PRC §40052 states: The purpose of this division is to reduce, recycle, and reuse solid waste generated in the state to the maximum extent feasible in an efficient and cost-effective manner to conserve water, energy, and other natural resources, to protect the environment, to improve regulation of existing

solid waste landfills, to ensure that new solid waste landfills are environmentally sound, to improve permitting procedures for solid waste management facilities, and to specify the responsibilities of local governments to develop and implement integrated waste management programs.

Over the long term it is most important to reduce the waste generated in the first place by purchasing materials with less packaging, not buying unnecessary items, and reusing materials as many times as possible. Reducing waste is something that everyone can do—children and adults—in institutions, homes, and large and small companies. The emphasis in schools should be on reduction and reuse as much as possible. Students will learn that money and time are saved by not generating the waste in the first place. In addition to reducing and reusing, recycling can be an effective method for schools to manage the waste they now generate and to save money and earn revenue from materials recycled. Staff from the CIWMB are available to assist schools in developing programs for reducing waste and reusing and recycling (including composting) materials.

Placing waste and other materials in landfills, once considered the primary method for waste disposal, is now seen as an option for managing waste after all the reducing, reusing, and recycling efforts have been explored. However, there will probably always be a need for landfills for those materials which cannot be reduced, reused, recycled, or incinerated (e.g., incinerator ash). Also, new technologies make landfills safer and less likely to leach toxics into the environment; and it is now common practice to capture the methane gas produced by landfills and use it as fuel.

Studies have been done to analyze the contents of the waste streams of schools. Paper makes up the largest component of schools' waste streams (see page 270). Therefore, reducing, reusing, and recycling paper in the classroom is one step that can be taken to lessen the amount of waste that is sent to a landfill.

One of the first steps in identifying opportunities to reduce, reuse, and recycle waste is learning how and where waste is being created. This



can be as simple as evaluating daily activities which generate waste to weighing and identifying types of materials which are discarded. The process of analyzing the waste stream of a classroom, school, home, or other place in the community is called a waste audit. The audit consists of evaluating qualitatively and quantitatively the types of waste which are created and the activities involved in producing the waste. The survey generally consists of interviewing employees and students, conducting a walk-through of the area being targeted (e.g., the classroom's trash can), conducting "dumpster peeks," and documenting the survey through charts and photos.

The survey may also provide insight to modifying the reduce, reuse, and recycle programs in the classroom, school, or community. As the survey is conducted, a record can be kept of

ideas which arise regarding reducing waste and reusing and recycling materials, which can be incorporated later.

An assessment of the waste produced in the class, school, or district is an enlightening educational and program-targeting tool. For example, one school district realized cost savings by not purchasing notepads. After conducting interviews, the district staff discovered that teachers and other staff members were very willing to use pads made from paper used on one side. The assessment can also provide a baseline for starting a reduce, reuse, and recycle program in the classroom and at school, so data will be available for future comparisons. As reduce, reuse, and recycle is practiced, everyone will be able to see the success of his or her efforts.

# LESSON 3: Model Community Relay

## LESSON'S CONCEPTS

- People can reduce their solid waste by learning the ways that waste can be sorted, according to materials which can be reused and recycled.
- Through the process of reusing and recycling, people can save the energy and natural resources it takes to acquire and manufacture items from raw materials.

### PURPOSE

Students will learn the difference between reusing and recycling, and they will learn that reusing and recycling materials are more energy-efficient practices than making new items from raw materials.

### OVERVIEW

In this lesson students will:

- Listen to and/or read parts of *Recycle!* by Gail Gibbons to identify the difference between reusing and recycling.
- Use clay to mold a new item and/or make recycled paper in order to understand the process of recycling.
- Compare reusing to recycling.
- Work in teams and participate in a relay race to show how waste can be diverted from a landfill through reusing and recycling practices.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students identify items that are reusable and recyclable and describe at least one way a reusable item can be reused.
  - Students "use details, examples, anecdotes, or experiences to explain or clarify information." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 26)

- Students classify ten objects by categories of those that can be reused, recycled, or need to be sent to a landfill.
  - Students "classify objects . . . based on appropriate criteria." (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 5a*)
- Students read *Recycle!* by Gail Gibbons to identify the difference between reusing and recycling.
  - "Students read and understand grade-level-appropriate material." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 21)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, relating, inferring

### TIME

30–45 minutes to prepare for the lesson;  
60–90 minutes to implement the lesson

### VOCABULARY

raw material, recycling

### PREPARATION

1. Read the "Background Information for the Teacher" at the end of this lesson.

- 2. Read “Procedure, Part II,” section “C” in this lesson and decide whether you want your students to mold clay, make recycled paper, or do both. If students will be making recycled paper, see the K–3 Module, Unit 2, Lesson 4, gather the materials, and follow the procedure described in that lesson.
- 3. Make a copy of “Model Community Relay Planning Sheet” for each group of students (page 339).
- 4. Find out what materials can be recycled in your community. Contact your local recycling coordinator for more information. (For a telephone number of your local recycling center, check your telephone directory.)

**Note:** For this lesson, students should know which items can be recycled in their community.

## MATERIALS

### For “Pre-Activity Questions”

- A pile (approximately ten pieces) of unsorted clean garbage and a plastic tarp on which to place the garbage (which should be different from the garbage described in Part III); there should be at least three recyclable (e.g., paper, cardboard, aluminum) and two reusable items (plastic container, article of clothing).

### For “Part I, Reading *Recycle!* by Gail Gibbons”

- The book *Recycle!* by Gail Gibbons (a second copy of this book could be useful)

### For “Part II, Understanding the Difference Between Reusing and Recycling”

- A piece of clay (about one-fourth of a pound) for each student and/or materials from the materials list from the K–3 Module, Unit 2, Lesson 4

### For “Part III, Participating in a Trash Relay Race”

- At least ten pieces of clean unsorted garbage for each team of five to eight students (Each team should receive the same type of garbage; for example: [1] piece of white paper; [2] piece of cardboard; [3] aluminum can; [4] plastic cup; [5] an article of clothing; [6] jar; [7] polystyrene [Styrofoam] meat tray or cup; [8] tissue; [9] soup can; and [10] paper plate.)
- Masking tape and nontoxic permanent marker

- One container for reusables labeled “reuse”
- One container for recyclables labeled “recycle”
- One container for waste to be landfilled labeled “landfill”

## PRE-ACTIVITY QUESTIONS

With the pile of unsorted garbage in front of the students, lead a discussion:

- Name three items in this pile that can be recycled. *Paper, cardboard, aluminum.*
- Name two items in this pile that can be reused. *Plastic container, article of clothing.*

**Note:** Students will learn the difference between reusing and recycling in this lesson, so you do not need to explain the difference at this time.

- When we put waste into a garbage can, where is it taken for disposal? *To the landfill.*

## PROCEDURE

### Part I, Reading *Recycle!* by Gail Gibbons

**Note:** Keep the pile of unsorted garbage where students can see it, as they read the book *Recycle!*

- A. Have students read *Recycle!* by Gail Gibbons. The reading can be separated into two sections, so one section could be read before recess and the other section after recess. You can also select specific pages for students to read, instead of having them read the entire book. One focus should be for students to find out about the connection that recycling has to saving energy. (The concept of *energy* was introduced in Lesson 1 in this unit.) Students should also become aware of how things are recycled. Consider using one of the following methods for the class to get the information from the book:
  - Have one student read a page and show the corresponding illustration to the class. Ask a second student to describe the illustration. Other students can add to the description of the illustration. Then have a third student read the next page, and have a fourth student describe the illustration. When a specific type of material is discussed in the book, students can select that material from the pile of unsorted garbage used in the “Pre-Activity Questions.”

**Note:** If you have access to two books, then one student can read while another can show the illustrations.

- Pages could also be made into overhead transparencies (you might need to ask the permission from the publisher to do this) and students can read these.
  - A class set of this book can be purchased, and each student can read independently. Then conduct a class discussion.
- B.** Discuss with students what the book, *Recycle!* says about recycling and energy. *Energy is saved when an item is made from recycled materials compared to when the item is made from raw materials.* If needed, share with students additional information about the amount of energy needed to make an aluminum can from scratch versus making a new aluminum can from a recycled can. (Recycling one aluminum can will save 95 percent of the energy that it would have taken to make a similar aluminum can from raw materials. See “Background Information for the Teacher” for additional information.)

## Part II, Understanding the Difference Between Reusing and Recycling

- A.** Discuss with students the difference between reusing and recycling. Explain that when an item is reused, it is used as is, although it might get decorated or cut. When an item is recycled, this “old” item will be remanufactured into a new item. Therefore, after you put an item in a place where someone picks it up to be recycled, the item is taken to a manufacturing plant where the item is made into another item. It could be that a can is made into another can, but in order to do that, the original can had to be melted and reshaped into a new can. Newspaper is often recycled to make new newspaper; other paper is recycled and made into cereal boxes and other boxes; used glass is made into new glass containers; and some plastics are recycled into new items, such as combs and plastic siding for homes.
- B.** To illustrate the difference between reusing and recycling, show students a can. Have students brainstorm ways this item can be reused and list these on the chalkboard.

- C.** To illustrate the idea of recycling, which is making a new item out of old material, do one or both of the following:
- Provide each student with a lump of clay. Ask the students to shape the clay into cans and pretend that they are aluminum cans. Then ask them to trade their “cans” with one another for purposes of recycling the cans. (This represents the transportation of recyclables to a location for recycling.) Each student should roll the clay can into a ball and mold another can out of it, or another item, such as an “aluminum” baseball bat. (This represents a manufacturing plant using recycled material to make new items.)
  - Conduct the lesson on paper recycling, described in the K–3 Module, Unit 2, Lesson 4.

## Part III, Participating in a Trash Relay Race

**Note:** Make certain that each team receives the same types of garbage for the relay. This makes the relay more equitable, because it ensures that the only variable will be how team members choose to dispose of or use the garbage.

- A.** Form teams of five to eight students in each team. Assign a number to each team. Make certain that each team has a waste pile containing the same type and equal number of recyclable or reusable items among the nonrecyclable and nonreusable items.
1. Provide the garbage to be used in the relay, masking tape, and a permanent marker to each team. Ask students to write their team’s number on a piece of masking tape and to tape it on each item.
  2. Explain that each team represents a community group that wants to lower the amount of waste going to the landfill. Provide a copy of the “Model Community Relay Planning Sheet” to each team. Review with students the materials that can be recycled in their school or community. If you were able to get brochures, have students read these as a group.
  3. Ask teams to sort their trash and categorize each item into one or two of the following areas:
    - Can be reused.

- Can be recycled.
  - Should be taken to a landfill.
4. Tell students that under the category of “can be reused,” each team must describe at least one way the item placed in that category can be reused.
  5. Give each team ten minutes to plan its waste disposal strategy and to complete the chart.

Type of trash	Reused (how)
White paper	Use it for scratch paper. Make an Origami. Make a book cover.
Jar	Coin holder. Water bottle.
Aluminum can	Cut it in half and use it as a planter. Make a pencil holder or a mini trash can.
Article of clothing	Use it to make a quilt. Use it to make doll dresses. Make a table cloth.
Styrofoam	Use it for a box for little toys. Make a bug house or science project.

Submitted by Tina Porter’s science class, Curtner Elementary School, Milpitas Unified School District.

- B. Set up the “reuse” container approximately 10 feet from the starting line; the “recycling” container 20 feet from the starting line; and the container representing the “landfill” as far away on the playground as is reasonably possible. This set up reflects the relative amount of energy required to replace the item for each waste management option.

**Note:** This relay does not necessarily reflect the energy it took for the consumer to reuse, recycle, or dispose of the item.

- C. Before beginning the relay, review different ways people can deal with waste. Ask students:
  - How does waste get to a landfill? *Residential garbage collection, self-haulers, commercial garbage collection.*
  - What costs are involved in getting waste to a landfill? *Fuel, labor, vehicle maintenance, cost of land space, cost of building and maintaining a landfill.*

- What reasons would communities have for locating their landfills as far away as possible? *Lower population; if situated near a community, there would probably be more traffic and noise from heavy equipment, as well as more air pollution.*
- Is there some type of waste that is not allowed to be dumped in a landfill? (Students might not know about household hazardous wastes.)

**Note:** Household hazardous wastes are introduced in the 4–6 Module, Unit 4.

- D. Have teams bring their lists, and lead students outside to participate in the relay.
  - Show students the playing area and the “reuse,” “recycle,” and “landfill” containers. Explain that the “reuse” container is closer than the “recycle” container because it takes less energy and natural resources to reuse an item than to recycle it into another product. Ask why the “landfill” container is farther away than the “recycle” container. (Students should say that it usually takes less energy and natural resources to recycle an item than to make a new item from raw materials.)
  - Explain the rules of the game: This is a modified relay race in which only one person at a time from each team can put something in one of the containers and only one item at a time can be deposited. Each group should follow the plan it recorded in the classroom.
- E. There are two suggested ways to organize this relay, “Option 1” and “Option 2.”

### Option 1

Call out each item (e.g., paper plate). One student from each team should grab the item and run to the appropriate container. As soon as one student (from any team) returns, call out the next item (e.g., article of clothing). Another member from a team cannot run until the previous team member has returned. Continue calling out items until all items have been placed in the containers.

- The winning team can be the one that finished first, reused the most number of items, had the least number of items placed in the landfill, or had the most creative ways of reusing items. (You can add win-

ning criteria until each team becomes a winner.)

- Have students share ways they planned to reuse items placed in the reuse box.

### Option 2

Allow students from each team to select the order of the items they will place in various containers. On a signal, one student from each team places one item in one container and returns to the team. When the team member returns and touches another team member, that team member can then run with an item and place it in the appropriate container. Team members continue running the relay until all items are placed in containers and the last team member is back with the team. Select one specific reason for each team to be a winner.

**Note:** A compost container can be added as an option. If it is backyard composting, then the container should be placed next to the reuse container. If it is curbside collection of compost materials, then the container should be placed next to the recycle container. Discuss with students why they think the compost container was placed at a specific distance (next to the reuse or the recycle container). Explain that composting is considered recycling, because the compost is usually changed to “new” soil.

**Note:** Composting is introduced in the 4–6 Module, Unit 3. Vermicomposting is introduced in the K–3 Module, Unit 3.

- F. When the last team finishes sorting its waste, gather everyone together. Bring the reuse, recycle, and landfill containers to class.

### DISCUSSION/QUESTIONS

- A. Review the items in the different containers. Are the items in the reuse bin items that are commonly reused? How often are these items really reused? Why? For example, point out that while some people occasionally reuse polystyrene (Styrofoam) cups or meat trays, most of them usually end up in the landfill.
- B. Ask students:
- What methods of waste disposal did each winning team use? *A team recycled and reused materials to the greatest extent possible; a team reused the most number of materials; a team had the least number of materials in the landfill container.*

- How is energy saved by recycling paper? Share with students that making one ton of paper from recycled paper uses 30–64 percent of the energy needed to make paper from raw material (wood). Discuss the meaning of *raw materials*. Raw materials are the original natural resources, such as trees, minerals, and fossil fuels, that are used by people to manufacture products.
- In what other ways is energy tied up in waste? *In acquiring the raw materials, in the manufacturing and transporting of products, in packaging that becomes waste.*
- What does our community do with our waste? *Some of it is recycled; the rest goes to a landfill.*
- What have we learned from this game that might help our school better manage its waste? *Our school should reuse and recycle more materials.*

### APPLICATION

**Note:** With younger students do “A” as a class.

- A. Ask students to work in groups and to select a material often recycled (other than paper), such as aluminum, glass, and plastic. Have each group develop an illustration or diagram of ways energy is used in bringing the object to the store, using raw materials, and then using recycled materials. Make a bulletin board display for your classroom or display the information on the school’s bulletin board.
- B. Remind students of the waste management hierarchy they were introduced to in Lesson 2:
- Waste prevention (also called source reduction) (reducing and reusing)
  - Recycling and composting (including buying products made from recycled materials)
  - Environmentally safe incineration (burning waste-to-energy) and land disposal (landfilling that minimizes impacts on the environment)
1. Reinforce the idea that because of the energy savings and the number of natural resources conserved, this hierarchy serves as a way of setting up priorities for dealing with garbage. Ask students:

- Which products can you reduce your use of?
  - How would your lives be different if you reduced your use of those products?
  - Which products couldn't you reduce your use of?
  - How will your lives be different if you reduce your use of those products?
2. Conduct a discussion on how students can reduce, reuse, and recycle items in their everyday lives.

C. Encourage students to write a pledge describing at least one thing they will do to reduce, reuse, and/or recycle.

**Project Idea:** Students set up recycling bins in areas at school or in a nearby park that do not have one.

## EXTENSION

Visit a nearby recycling center in your community or invite a community recycling coordinator to speak to your class.

## RESOURCES

### Videos

*Recycle.* Chatsworth, Calif.: Pied Piper/ AIMS Media, 1992 (16 minutes).

Shows how several items are broken down, sent through the recycling process, and manufactured into new products.

*Recycle It!* Northbrook, Ill.: Film Ideas, Inc., 1993 (16 minutes).

A music video featuring the World Patrol Kids, who explain how aluminum, plastic, paper, and glass are recycled at industrial plants.

*Recycle That Trash.* Santa Monica, Calif.: Pyramid Film and Video, 1990 (18 minutes).

Shows students from the town of Goleta, California, participating in various recycling activities. The students visit a landfill, a transfer station, and a recycling center and begin recycling programs at home.

*Recycling.* Earth Science series. Northbrook, Ill.: Film Ideas, Inc., 1994 (20 minutes).

Shows how products get to market through the mining, milling, and refining of raw materials. Explains why recycling and reprocessing waste is important.

*Recycling: The Endless Circle.* Washington, D.C.: National Geographic, 1992 (25 minutes).

Explains how recycling returns used materials to make new products, therefore reducing waste. The processes involved in recycling paper, aluminum, and plastic are described.

*A Recycling Update.* The Green Earth Club series. Chatsworth, Calif.: AIMS Media, 1992 (15 minutes).

Explains how used bottles and cans are processed into new materials.

### Books

*Fifteen Simple Things Californians Can Do to Recycle.* Prepared by The EarthWorks Group and the California Department of Conservation's Division of Recycling. Berkeley: EarthWorks Press, 1991. Prepared for and distributed by the California Department of Conservation.

Provides information on how to recycle.

Gibbons, Gail. *Recycle! A Handbook for Kids.* New York: Little, Brown and Company, 1992.

Easy-to-read style and colored illustrations explain the importance of recycling and describe how various materials are recycled.

### Websites

The California Integrated Waste Management Board's website is: [www.ciwmb.ca.gov](http://www.ciwmb.ca.gov).

The Steel Recycling Institute's website is: [www.recycle-steel.org](http://www.recycle-steel.org).

For additional websites, see "Appendix F-I, Award and Activities websites," and "Appendix F-V, Recycling websites."

Team Members: \_\_\_\_\_

Team Captain: \_\_\_\_\_

## MODEL COMMUNITY RELAY PLANNING SHEET

List each type of waste, describe how it can be reused, and put a check mark in the appropriate column to indicate whether it can be recycled or needs to be taken to a landfill.

Type of waste	Can be reused (describe how)	Can be recycled (or composted)	Needs to go to the landfill
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			



# BACKGROUND INFORMATION FOR THE TEACHER

In California in 1997, approximately 32 percent of the garbage was diverted through waste prevention and recycling (including composting), 2 percent was incinerated (waste-to-energy), and 66 percent was put in landfills.<sup>1</sup> When solid waste is diverted from the landfill through reusing and recycling efforts, natural resources (including energy resources) are conserved.

Recycling is the process of taking an item and remanufacturing it into another item. Technically, recycling is different from reusing. When you reuse an item, you use it as is, although you might cut it or decorate it. When you recycle an item, this item will be remanufactured into a new item. For example, an aluminum can is melted down and reshaped into a new aluminum can or another aluminum product. Newspaper is often recycled to make new newspaper; other paper is recycled and made into cereal boxes and other boxes. Used glass is made into new glass containers or asphalt (called “glassphalt”) for roads. Some plastics are recycled into new items, such as hair combs and plastic siding for homes.

When an item is recycled, and therefore manufactured into another product, much less energy is needed to manufacture that new product, compared to the energy that would have been needed to produce the product from raw materials (i.e., newly extracted material). For more information on recycling, see “Appendix B–III, Recycling.”

Aluminum is made from a mineral called bauxite. Bauxite ore is found in rocks, and large amounts of energy (usually fossil fuels to power bulldozers, trucks, and other machines) are needed to dig up the rock, ship the rock to a manufacturing plant, and separate the bauxite from the rock. Then it takes large amounts of energy to create aluminum from the bauxite ore as it is mixed with soda ash and lime and put under pressure. Then energy (often provided from burning coal and oil) is needed to melt the aluminum, which is then poured into molds. Finally, energy is used to transport the molded items to distribution centers and the completed products to stores.

On the other hand, recycling one aluminum can saves 95 percent of the energy that would be used

to make an aluminum can from raw materials.<sup>2</sup> Enough energy is saved by recycling one aluminum can into another to power a television for three hours. This is approximately equal to the energy that can be produced by half a can of gas. For more information on aluminum, see “Appendix C–I, Aluminum.”

Recycling other materials, such as paper, also saves energy. Making one ton of paper from recycled paper uses 50–70 percent less energy than it would have taken to make paper from raw material (wood). In addition to saving energy, the process of recycling reduces the amount of water and soil that would have been needed if raw materials had been extracted and processed to produce the paper. The recycling process also creates less air pollution. For more information on paper, see “Appendix C–VII, Paper.”

The purpose of this lesson is to emphasize to students that when materials are placed in a landfill, the materials from which the item was originally made are also disposed, and the energy that it took to make the item is wasted. Therefore, by placing the “recycling” container in the relay (in this lesson) closer to the students than the “landfill,” there is an emphasis that through recycling, natural resources, energy, and fossil fuels are conserved. We are also saving landfill space.

Reusing an item is more energy efficient than recycling, because the item typically does not need to be shipped anywhere and remanufactured into another product. Some people are concerned that recycling has been made so convenient that many people choose not to reuse items. In the relay, the reuse container is closer than the recycling container to show that reusing items is more energy efficient than recycling the same items.

Reducing waste saves more energy and natural resources than would be saved through reusing or recycling materials. By “reducing” the amount we use, we generate little or no waste. The concept of reducing will be addressed in the 4–6 Module, Unit 2, Lesson 5.

<sup>1</sup>Written communication on November 23, 1998, from John Sitts, Supervisor, Waste Analysis and Methods Section, Waste Analysis Branch, California Integrated Waste Management Board.

<sup>2</sup>G. Tyler Miller, Jr. *Environmental Science: Working with the Earth* (Fifth edition). Belmont, Calif.: Wadsworth Publishing Company, 1995, p. 345.

# LESSON 4: Packaging: What a Waste!

## LESSON'S CONCEPTS

- Packaging is useful and necessary for many reasons.
- Packaging is a major component of the waste stream. People can reduce the amount of garbage they generate by making thoughtful and informed choices when they buy packaged products.
- Excessive packaging and processing can waste natural resources and increase the amount of solid waste requiring disposal.

### PURPOSE

Students will learn the purposes of packaging and how excess packaging contributes to the solid waste requiring disposal.

### OVERVIEW

In this lesson students will:

- Determine the purposes of a variety of packaging.
- Identify the materials used in packaging.
- Compare the amount of packaging and costs of the same product when placed in a large package as compared to being packaged in individual containers.
- Work in groups to compare the costs of various potato products that are processed and packaged differently.
- Classify packaging according to categories, based on the purpose or function of the packaging.
- Evaluate wasteful packaging.
- Recognize packaging made from recycled materials.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students classify packaging according to categories, based on the purpose or function of the packaging.
  - "There is no perfect design. Designs that are best in one respect (safety or ease of use, for example) may be inferior in other ways (cost or appearance)." (*Benchmarks for Science Literacy*, page 49)

- "Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . Students will: classify objects . . . based on appropriate criteria . . ." (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 5a*)
- Students compare the amount of packaging to the size and cost of a product. They also compare the ways potatoes and potato products are packaged.
  - "Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings." (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 18)
  - "Students will: . . . record data using appropriate graphical representation (including charts, graphs, and labeled diagrams), and make inferences based on those data . . ." (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 6g*)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, relating

### TIME

30–60 minutes to prepare for the lesson; 45–60 minutes for each of the four sections

### VOCABULARY

packaging

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. Make a transparency of “Energy for Making a Cardboard Box” (page 351).
- 3. Ask students to bring samples of:
  - Nature’s packaging (e.g., bananas, oranges, apples, nuts)
  - Packaging that could be reused (e.g., cottage cheese containers and other plastic containers, plastic bags, paper bags)
  - Packaging that could be recycled (e.g., aluminum and tin cans, foil wrap)
  - Excessive packaging or packaging that is difficult to recycle (e.g., polystyrene from meat trays; individually wrapped packets; packaging combining metal and paper with plastic, such as boxed juices)

**Note:** Each student should bring only one example of any of the packaging listed in “Preparation” step “2.”

- 4. Make copies of “Purpose or Function of Packaging” for each group of three or four students (pages 352 and 353).
- 5. Obtain a large bag of potato chips and the same amount of potato chips (by

weight) in small individual packages (the same brand of chips should be bought for accurate cost comparisons). Keep receipts for cost comparisons.

- Note:** If small individual packages of potato chips are not available, use another product (e.g., crackers or cookies) that come in a large bag/box and in individually packaged bags/boxes.
- 6. Purchase five food items packaged in the following ways and label “A,” “B,” “C,” “D,” and “E”:
    - A. A product in a plastic container (e.g., yogurt)
    - B. A product in packaging made from recycled material (e.g., cereal in a cardboard box)
    - C. An apple, banana, or other fruit
    - D. A product in an aluminum can (e.g., soda)
    - E. A product which has eye-catching and excessive packaging, wrapped in more than one layer so that the product appears larger (e.g., fancy cookies, candy, or a toy)
  - 7. Make a transparency of “A Spud by Any Other Name 1” (page 354). If you want your students to complete

(Use school’s letterhead.)

Dear Parent or Guardian,

Please read the following information with your child:

Our class is studying packaging. Students will analyze why products are packaged and which products appear to be overpackaged (and therefore add to our solid waste). Would you please collect and send with your child one example of any of the following food packaging:

- Nature’s packaging (for example, banana, orange, apple, nut)
- Packaging that could be reused (for example, cottage cheese container and other plastic containers, plastic bags, paper bags)
- Packaging that could be recycled (for example, aluminum and tin cans, foil wrap)
- Excessive packaging or packaging that is difficult to recycle (for example, polystyrene from meat trays; individually wrapped packets; packaging combining metal and paper with plastic, such as boxed juices).

Please rinse these packages, if needed, and have your child bring them to class on \_\_\_\_\_.

Your cooperation in this matter is greatly appreciated.

Thank you,

the calculations in the price and pound column, make a copy of “A Spud by Any Other Name 2,” for each group of students (page 355).

- 8. Make a copy of “Analyzing the Cost and Packaging of a Product” for each group of two or three students (page 356).

## MATERIALS

### For “Pre-Activity Questions”

- The transparency, “Energy for Making a Cardboard Box”

### For “Part I, Looking at the Purpose or Function of Packaging”

- Samples of different types of food packaging (e.g., paper boxes, metal cans, plastic bottles and bags, glass containers, foil wrappings, polystyrene trays) brought by students
- A copy of the chart, “Purpose or Function of Packaging,” for each group of three or four students

### For “Part II, Comparing the Size of the Package to the Amount of the Product”

- Weight scale
- A large bag of potato chips and the same amount of potato chips in small individual packages (or other products that come in a large bag and in small individual packages)

**Note:** If students are planning to eat the potato chips, provide a bowl in which the chips can be placed before the empty bags are weighed. If students will be handling the chips to weigh them, provide plastic gloves for students who will be handling them to keep the chips from getting contaminated.

### For “Part III, Analyzing Ways Potatoes and Potato Products Are Packaged”

- A transparency of “A Spud by Any Other Name 1” (If students will be calculating costs, then make a copy of “A Spud by Any Other Name 2” for each group of three or four students.)
- Calculator (if using “A Spud by Any Other Name 2”) for each group of three or four students
- The chart, “Analyzing the Cost and Packaging of a Product,” for each group of two or three students

## PRE-ACTIVITY QUESTIONS

### A. Ask students:

- What products usually come in packages? *Many food items, cosmetics, toys.*
- What products usually do not come in packages? *Clothing, fruits and vegetables, books.*

### B. Tell students that in this lesson, they will focus on the packaging of food items. Ask students:

- What types of food come in packages; i.e., packaging that people make? *Canned foods; frozen foods; perishable foods; drinks; snacks, like potato chips.*
- What types of food usually do not come in packages? *Fresh produce, items sold in bulk (in barrels or bins).*

### C. Ask students to identify food items that are packaged in the following ways:

- Paper or cardboard; e.g., *cookies, cereal, eggs, cubed butter*
- Plastic; e.g., *noodles, salad mixes, candy, catsup*
- Aluminum; e.g., *soft drinks, other drinks*
- Steel/tin; e.g., *soup, canned vegetables, pet food*
- Glass; e.g., *fruit juice, vegetable oil, mayonnaise*
- Mixed materials; e.g., *boxed fruit juices, pet food in a bag*

### D. Discuss which categories of natural resources were used to produce the packaging. For example:

Picture intentionally deleted.

Students from Janet Cohen’s sixth-grade class at Gold Trail Elementary School look at various types of packaging.

- Paper or cardboard; *trees (plants)*
- Plastic; *fossil fuels (energy sources)*
- Aluminum; *minerals*
- Steel/tin; *minerals*
- Glass; *minerals*
- Mixed materials; *more than one natural resource, such as trees and fossil fuels*

- E. Show the transparency of “Energy for Making a Cardboard Box.” Ask students to explain how energy is used to produce packaging. *To grow trees; to harvest trees; to obtain petroleum for energy, for transporting trees and the processed materials; to provide electricity to operate the lumber mill, manufacturing plant, packaging business, and store.*

## PROCEDURE

### Part I, Looking at the Purpose or Function of Packaging

In this activity students determine why food products are packaged a certain way.

- A. Introduce the activity by passing around samples of different types of food packaging which the students brought to class. Ask students to identify the purpose or functions of food packaging. That is, why is the product packaged in that way? Develop a class list. For example, the purpose or function of the package is for:
- Preservation of product: to keep food fresh
  - Protection of product: to keep the contents from damage during shipping
  - Sanitation: to keep the item clean and uncontaminated
  - Consumer safety: to prevent tampering (e.g., having someone add something harmful to the product)
  - Complying with regulatory standards imposed by government regulations
  - Identification of product: to identify the product inside the package
  - Theft protection: to prevent the item from getting stolen
  - Provision of instructions: To provide instruction on how to use or prepare the item in the package
  - Convenience: to make it easier to

Picture intentionally deleted.

Students from Nona Reimer’s fifth-grade class at John Malcom Elementary look at various types of packaging.

carry home; to keep small items together

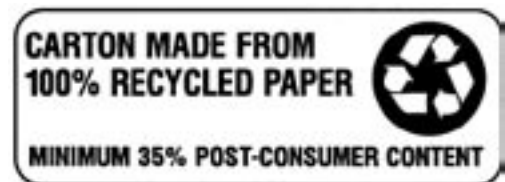
- Advertising: to make you want to buy it
- B. Collect the packaging that students brought.
- C. Divide the class into five groups and provide each group with the chart, “Purpose or Function of Packaging,” and one food package gathered in “Preparation” #6 (labeled ‘A’, ‘B’ etc.)
- As the groups complete their charts for one item, allow them to pass their packages to other groups so that each group analyzes a total of five packages.
  - Ask students to complete “Part I” on their chart, “Purpose or Function of Packaging.”
  - Have students report what they learned.
  - Discuss with students:
    - From what materials were various packaging made? *Plastic, paper, aluminum.*
    - Which packaging seems most important? *The one for the preservation and protection of the product.* (Answers will vary.) Have students offer explanations for their answers.
    - Which product has the most packaging?
    - Is there any packaging that is making the item seem bigger and more eye-catching? If so, why was the item packaged in that way? *To make you want to buy the product.*

- Did any packaging appear unnecessary or excessive? Have students offer explanations.
- Why is excessive packaging a problem? *It uses up too many raw materials and usually gets placed in a landfill after one use.*
- Of the packaging that was most excessive, what materials and natural resources were used in making the packaging? *Cardboard (trees), plastic (fossil fuels).*
- How could the packaging have been made in order to conserve natural resources? *Less packaging used; packaging made from recycled materials; packaging that could be recycled.*
- What do people usually do with the packaging after they use the product? *They throw it into a garbage can. Sometimes they throw it on the ground and it becomes litter.*
- Where does packaging go when it is thrown in a garbage can? *To the landfill.*

Picture intentionally deleted.

A student from Valley Oak Elementary School examines a package.

- Can something else be done with the packaging? *Some packaging might be reused or recycled.*
- What could be recycled? (The answer will depend on what is currently accepted for recycling in your community.) *Aluminum cans, glass jars, plastic bottles.*
- What packaging was made from recycled products? How do we know that a package is made from recycled products? (These packages usually have the standard recycling logo with the three arrows printed on the package.) Why is it a good idea to buy packages made from recycled products? *This conserves natural resources because fewer raw materials were probably needed to make the recycled products.*



Picture intentionally deleted.

Two students from Nona Reimer's fifth-grade class at John Malcom Elementary School examine a package.

**Note:** The goal of this activity is to learn what students understand at this point about what is desirable or necessary, undesirable or unnecessary, concerning packaging. Depending on the students' answers, you may wish to continue the discussion, especially if your school has begun a reducing, reusing, and recycling program or if students live in communities where there are recycling programs already underway.

D. Ask students to complete "Part II" in the "Purpose or Function of Packaging." Have groups report back to the class. Discuss with students:

- Which packages can be reused or recycled?
- How can we reuse the packaging?
- What will happen to the packaging we cannot reuse or recycle?

E. Ask students to complete "Part III" in the "Purpose or Function of Packaging." Conduct a discussion of their ideas.

F. Ask students whether they think the amount and type of packaging affect the cost of different food products. What percent of the cost of packaged foods do they think is due to packaging? Record students' guesses. Tell students that packaging can often add about 10 percent more to the cost of the product. This means that for every dollar (or 100 cents) they spend, 10 cents goes to packaging.

G. Discuss the following with students:

- What are the advantages of packaging?
- How can packaging actually reduce the volume of waste of the items inside the packaging? *By reducing spoilage and damage of these items.*
- Is packaging necessary for all types of food? Have students explain their answers.
- Which packaging is least wasteful of natural resources? Which is most wasteful? What criteria might you consider when deciding whether packaging is necessary or wasteful?
- Which of your favorite foods could you buy without packaging?

- What should we do with the packaging that everyone brought to class? (Some of it can be used in "Application.")

**Note:** You might want to keep the packaging for arts and crafts projects and/or for Lesson 10.

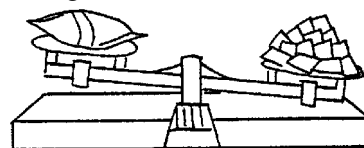
## Part II, Comparing the Size of the Package to the Amount of the Product

In this activity students compare the sizes of the packages containing the same type of product, potato chips.

A. Show students a large bag of potato chips and the same amount of potato chips in small individual packages.

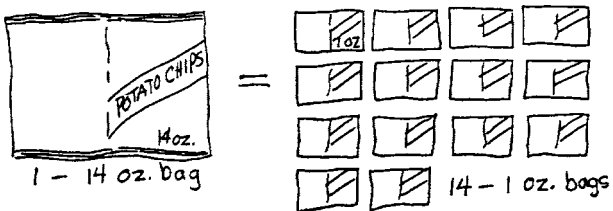
**Note:** If students are planning to eat the potato chips, the chips can be placed in a bowl as the bags are weighed. If students will be handling the chips to weigh them, have them use plastic gloves to handle the chips to keep them from getting contaminated.

1. Have students weigh the large bag of chips and the empty bag. Record both weights. Show students that they can subtract the weight of the bag from the total weight of the bag and chips to get the weight of the chips. (This information should also be on the package.) Students might want to check their subtraction figures and the accuracy of the weight indicated on the bag by weighing the contents of the bags.
2. Weigh all of the small individual bags with the chips and then only the bags. Record the weights. Show students that they can subtract the weight of all the bags from the total weight of the bags and chips to get the weight of the chips. They can also use the weight information of the bag. If students want, they can check their subtraction figures and the accuracy of the weight indicated on the bags by weighing the contents of all the small bags.



3. Have students compare the weight of the large bag to the weight of all the small bags.
4. Ask students to cut the bags and spread out the packaging paper to compare the

amount of paper used for the large bag to the total amount of paper used for the small bags. Include the large bag or box in which the little bags came. This could be placed on a bulletin board for visual effect.



**Note:** Older students could calculate the area of the wrapper. To determine the area, students will need to measure and multiply the length times the width of the wrapper. So if the wrapper measured six inches by eight inches, the area would be 48 square inches.

5. Discuss with students:

- Which products could be bought in bulk or in large containers? *Fruits and vegetables, breakfast cereal, rice, beans, candy.*
- What are the advantages of buying items in large quantities (or in bulk)? *The item is less expensive per serving, and there is less packaging that goes to the landfill or that needs to be recycled.*



A comparison of weights of single-serving boxes to a multiple serving box is displayed at the Davis Street Educational Center, San Leandro, California; operated by Waste Management, Inc.

**Homework Assignment:** Ask students to work in groups to create a display to show the packaging of a selected product. For example, a group can compare the amount of packaging of an economy-sized cereal box to several small individual-sized cereal boxes. They will need to get enough small boxes so that their total amount of cereal will equal the amount in the large box.

6. Ask students to guess how much of our trash is packaging. Tell them that

Picture intentionally deleted.

Students from Janet Cohen's sixth-grade class at Gold Trail Elementary School compare the weight of a large potato chip bag to small individual packages containing the same amount of potato chips.



it makes up to 40 percent of household garbage. Have students determine a way to graphically show 40 percent. This can be done using a graph or chart.

7. Ask students what types of packaging the potato chips are in that they bring to school. Discuss other options for packaging these chips to create less waste. *Reuse the plastic bags; use reusable plastic containers.*

### Part III, Analyzing Ways Potatoes and Potato Products Are Packaged

In this activity, students compare the packaging of the same type of product that is processed in different ways (e.g., fresh potatoes, instant mashed potatoes, canned potatoes).

- A. Decide to do “Option 1” and “Option 2” if you want students to calculate the price per pound. Do “Option 2” only if you do not want students to do the calculations.

**Option 1:** If you want students to calculate the price per pound, provide a calculator and a copy of “A Spud by Any Other Name 2” to each group. Complete several calculations as a class until students understand how to do these calculations. Then ask the groups to complete the calculations for the rest of the products.

**Option 2:** If you do not want your students to calculate the price per pound (or if students have completed the calculations), project the chart “A Spud by Any Other Name 1” on an overhead projector and ask the following questions:

- Which forms of the potato seem to be most highly processed?
  - Which forms are most expensive per pound?
  - Which form of potato would you purchase if you were interested in reducing solid waste?
  - Which form of potato would you purchase if you were interested in saving money?
  - What relationships are there among cost, amount of processing, and packaging of products?
- B. Ask students if packaging is necessary for all types of food. Encourage students to explain their answers.
  - C. If possible, take students to a grocery store. Otherwise, have students complete this

assignment as homework. The chart may need to be adjusted if your community has small grocery stores.

- Divide students into groups of two or three.
- Instruct each group to choose a fresh food item to investigate, such as apples, peanuts, tomatoes, or corn.
- Provide the chart, “Analyzing the Cost and Packaging of a Product,” for each group.
- Ask students to complete their charts for the fresh form of their product and for five different processed forms of the product (e.g., frozen, canned, whole, canned cut, creamed or pureed, dehydrated).
  - One way to do this is for group members to assign specific types of products for each student to research. If this approach is used, you will need to provide each student with a copy of the chart.
  - Another way to do this is for one student to volunteer to do the entire chart and bring it to class. The rest of the group members can then complete the calculations.

**Note:** Students should try to get the same type of weight measurements for easy comparison. You might need to explain to students that there are 16 ounces in one pound and encourage them to convert all products on their charts into ounces or pounds.

- D. Have students within their groups consolidate their data on one group chart and present the results to the class.
- E. After all groups have collected their data, conduct a whole class discussion, addressing the following questions:
  - Which form of your food item is most expensive per pound? Why? Which form do you think takes the most energy to produce? (The concept of energy was introduced in the 4–6 Module, Unit 2, Lesson 2.)
  - What relationships are there among cost, amount of processing, and packaging of products?
  - Which of these products will you buy in the future?

- What criteria will you use for making your decisions about what to buy and what not to buy?

## DISCUSSION/QUESTIONS

- Ask students how they can reduce the amount of packaging they throw away. *Buy items with less packaging; buy items in packaging that can be recycled.*
- Discuss the importance of packaging. Review the class list developed in “Part I” on the purposes of packaging. Then discuss the drawbacks or trade-offs of packaging. Make a class list of some drawbacks or trade-offs. For example:
  - Packaging increases the cost of the product.
  - Most packaging ends up in a landfill.
  - Some packaging becomes litter and makes an area ugly and can injure people and wildlife.
  - Packaging can make a product look bigger and better than it really is.
  - Natural resources are used to make packaging.

## APPLICATION

**Homework Assignment:** Ask students to record the type and amount of packaging that is thrown away or recycled for one week. One way to do this is to have students collect clean packaging in a separate cardboard box for one week and then record what was collected. Or, the students can peek in their garbage cans at the end of the day and record what they see. Students should also describe ways they can decrease the amount of packaging that is being thrown away or recycled at home.

- Ask students to share their homework assignments.
- Write the following on the chalkboard, but in a different order from the one below. Have students rate the following in order of least wasteful to most wasteful and explain their answers:
  - No packaging
  - Refillable (or reusable) packaging made from recycled products
  - Packaging that is reusable

- Packaging made from recycled products and is recyclable
- Packaging that is made from recycled products
- Amount of packaging limited to one layer

- Have students in each group select one type of cookie they want to package. Students should decide what the purpose of the package should be. Then ask them to describe and draw the package and possibly make it. (Some packaging from “Part I” could be used.) Remind students to design packages which reflect their awareness of the importance of waste reduction.
- Ask students to:
  - Identify two environmental and/or waste management problems associated with packaging. *Litter and need for disposal*
  - Design a list of recommendations for selecting and purchasing food products: For example:
    - Choose products in recyclable, returnable, or refillable containers.
    - Avoid excessive packaging (For example, avoid items that are packaged in plastic bubble wrap.)
    - Buy products in bulk and in larger sizes.
    - Buy unwrapped fruits and vegetables.
    - Avoid snack items in single-serving packages.
    - Support companies that provide minimal packaging and use packages made from recycled products.
    - Carry products home in cloth or string bags.
- Ask students what action would be most responsible from the standpoint of reducing solid waste if they were asked at a grocery store whether they wanted paper or plastic bags. Students should be aware that bringing their own cloth or string bags is the best option. If a cloth bag is not available, students should consider that paper comes from renewable natural resources and plastic from nonrenewable natural resources. A paper bag can be reused several times and then recycled. However, a plastic bag could

also be selected if a household reuses the plastic bag several times before recycling it, or uses it to line kitchen garbage cans (instead of buying new plastic bags).

- F. Ask students to write in their journals how they could reduce the amount of packaging used with the items that they purchase.

How could you reduce the amount of packaging you use?  
I can buy things that are not packed in 2 or 3 layers of plastic or any other material. I can also not buy a few little things of the same kind and instead buy one big thing.

Submitted by Janet Cohen, sixth-grade teacher, Gold Trail Elementary School, Gold Trail Union School District.

## EXTENSIONS

- A. Ask students to rank/order the food products investigated from “most packaging/processing” to “least packaging/processing” and construct a graph illustrating the relationship between cost and packaging. Then ask them to interpret and describe the graphed relationship in one to two sentences.
- B. Assign students to prepare a personal plan for reducing the amount of excess packaging used with the items that they purchase.
- C. Ask students to notice, at the grocery store, which brands of products seem most over-packaged. As a problem-solving activity, ask students to brainstorm ways they can convey their findings to companies that use excessive packaging. How can students address the issue as a mutual problem? What are likely to be the most effective ways to communicate? Assign students to test their ideas.
- D. Have students analyze packaging of fast food restaurants. Ask them to identify how much packaging was used and whether the packaging is recyclable or reusable. If the packaging is reusable, how can it be reused? Encourage students to creatively reuse the packaging and bring their creations to class.
- E. Have students analyze the following: If you buy things in larger containers, does it reduce waste? Students can compare six 6-oz. juice bottles to a 36 oz. juice bottle. Allow students to drink the juice and compare the amount and weight of the containers.
- F. Have students conduct a survey in school lunchrooms or at snack booths. Find out why students buy a product. Did they consider how much product they actually bought and how much of what they bought (including packaging) ended up being thrown away?

## RESOURCES

### Videos

*Recycling Is Fun*. Oley, Pa.: Bullfrog Films, 1991 (12 minutes).

Three children explore the three Rs of recycling—reduce, recycle, reuse. To educate themselves, they visit a landfill, a recycling center, and their local supermarket to find out what they can do to help to manage solid waste. While visiting the grocery store, the children look for new products made from, or packaged in, recycled paper or plastic containers. They discover their own power to recycle and choose what they buy. For grades K–4.

*Garbage Tale: An Environmental Adventure*. Los Angeles, Churchill Films, 1990 (18 minutes).

A boy dreams that he visits a landfill and recycling center and learns about reducing, reusing, and recycling. Shows that one bag of groceries can create three bags of waste.

### Books

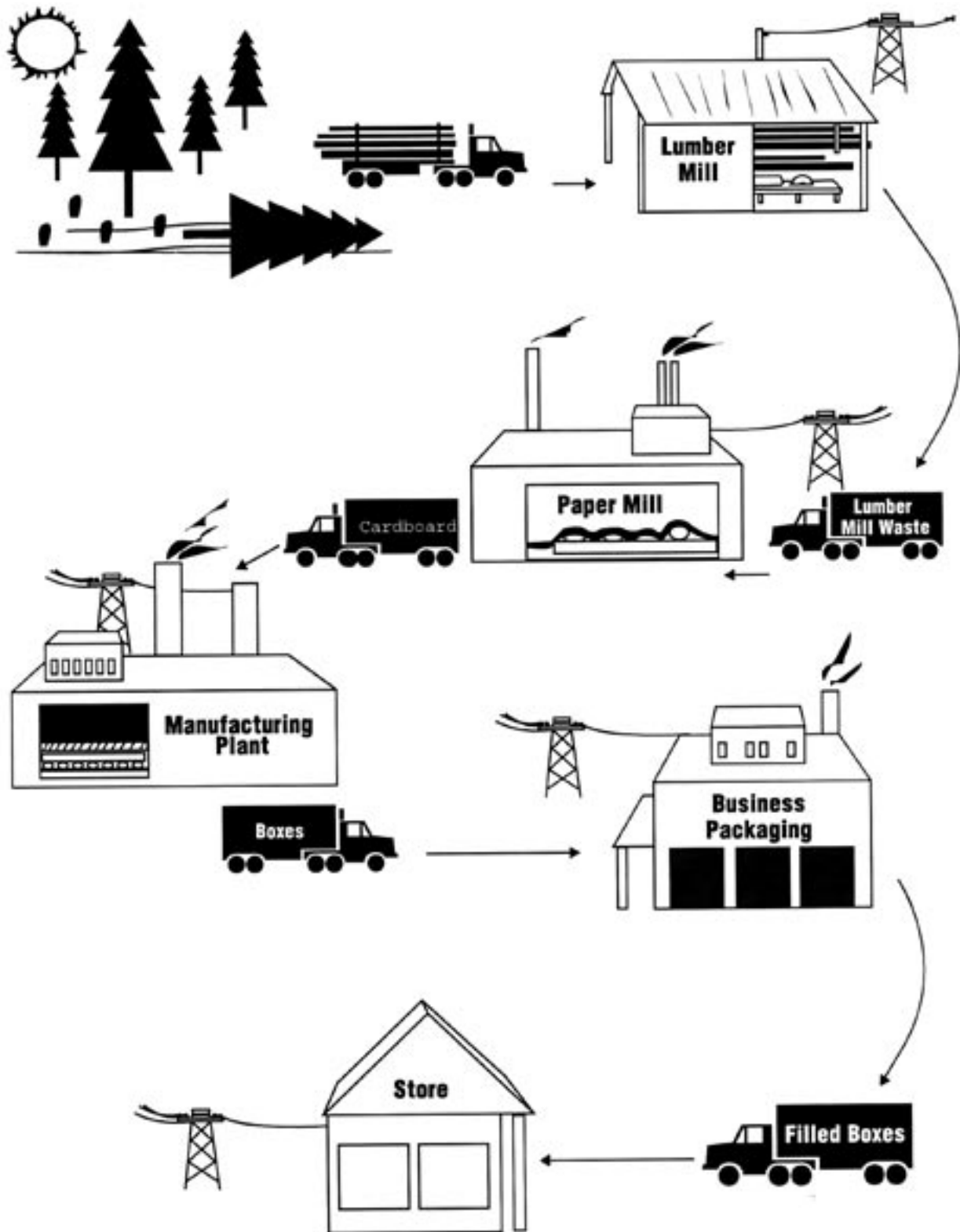
Kalman, Bobbie. *Reducing, Reusing, and Recycling*. The Crabtree Environment series. New York: Crabtree Publishing Company, 1991.

Describes the three Rs and how to become a wise consumer.

Harlow, Rosie, and Sally Morgan. *Garbage and Recycling*. Young Discoverers series. New York: Larousse Kingfisher Chambers, Inc., 1995.

Provides information about reusing, recycling, packaging, litter, and worms. Recommends activities for students to learn more about the solid waste problem and how to help solve it.

## ENERGY FOR MAKING A CARDBOARD BOX



Name: \_\_\_\_\_ Date: \_\_\_\_\_

## PURPOSE OR FUNCTION OF PACKAGING

Part I. Write the name of each item for which you are analyzing the package. Check off the function or reasons for the packaging. Then check whether the amount of packaging is necessary (#12) or whether the product appears to be overpackaged (#13).

### Function of or reason for the packaging

Name of item	1. Preservation of product	2. Protection of product	3. Sanitation	4. Consumer safety	5. Complying with regulatory standards	6. Identification of product	7. Theft protection	8. Provision of instructions on how to use product	9. Convenience	10. Advertising	11. Other _____	12. Amount of packaging seems necessary	13. Appears to be over-packaged
A _____													
B _____													
C _____													
D _____													
E _____													

Part II. Which of the items (listed under A, B, C, D, and E above) are packaged in:

A. Natural packaging (no paper, plastic, or other human-made materials)?

---

B. Reusable packaging?

---

C. Recyclable packaging (packaging that can be recycled)?

---

D. Nonrecyclable packaging?

---

E. Packaging made from recycled materials?


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Part III. Select one of the products and its packaging. Describe another way that this product could have been packaged. You can illustrate your newly designed package.

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# Transparency

## A SPUD BY ANY OTHER NAME 1

Product	Package size	Price	Price/pound (lb.) <sup>1</sup>	How packaged
Fresh russet potatoes	5 lb.	\$ .99	\$ 0.20	Plastic bag
Fresh russet potatoes	10 lb.	\$ 1.69	\$ 0.17	Plastic bag
Fresh russet potatoes	4 lb.	\$ 1.00	\$ 0.25	Bulk
Canned potatoes—sliced	15 oz.	\$ .75	\$ 0.80	Can (steel)
Canned potatoes—whole	15 oz.	\$ .75	\$ 0.80	Can (steel)
Tater tots—frozen	32 oz.	\$ 2.85	\$ 1.43	Plastic bag
Tater tots—frozen	5 lb.	\$ 5.55	\$ 1.11	Plastic bag
Mashed potatoes—frozen	22 oz.	\$ 2.39	\$ 1.74	Plastic bag
Hash brown patties—frozen	24 oz.	\$ 2.39	\$ 1.60	Cardboard box
Hash browns (southern style)—frozen	32 oz.	\$ 2.79	\$ 1.40	Plastic bag
French fries (crinkles)—frozen	32 oz.	\$2.75	\$ 1.38	Plastic bag
Shoestrings potatoes—frozen	20 oz.	\$ 2.17	\$ 1.74	Plastic bag
Potato chips	9 oz.	\$ 2.09	\$ 3.72	Plastic bag
Potato chips	14 oz.	\$ 2.99	\$ 3.42	Plastic bag
Instant mashed potato buds	5.5 oz.	\$ .99	\$ 2.88	Cardboard box
Instant mashed potato buds	13.75 oz.	\$ 2.45	\$ 2.85	Cardboard box
Instant mashed potato buds	1 lb. 12 oz.	\$ 3.75	\$ 2.14	Cardboard box
		\$	\$	
		\$	\$	
		\$	\$	

1 lb. = 16 oz.

<sup>1</sup>Prices gathered in Lakeport, California on July 25, 1997.

## A SPUD BY ANY OTHER NAME 2

Product	Package size	Price	Price/pound (lb.) <sup>1</sup>	How packaged
Fresh russet potatoes	5 lb.	\$ .99		Plastic bag
Fresh russet potatoes	10 lb.	\$ 1.69		Plastic bag
Fresh russet potatoes	4 lb.	\$ 1.00		Bulk
Canned potatoes—sliced	15 oz.	\$ .75		Can (steel)
Canned potatoes—whole	15 oz.	\$ .75		Can (steel)
Tater tots—frozen	32 oz.	\$ 2.85		Plastic bag
Tater tots—frozen	5 lb.	\$ 5.55		Plastic bag
Mashed potatoes—frozen	22 oz.	\$ 2.39		Plastic bag
Hash brown patties—frozen	24 oz.	\$ 2.39		Cardboard box
Hash browns (southern style)—frozen	32 oz.	\$ 2.79		Plastic bag
French fries (crinkles)—frozen	32 oz.	\$2.75		Plastic bag
Shoestrings potatoes—frozen	20 oz.	\$ 2.17		Plastic bag
Potato chips	9 oz.	\$ 2.09		Plastic bag
Potato chips	14 oz.	\$ 2.99		Plastic bag
Instant mashed potato buds	5.5 oz.	\$ .99		Cardboard box
Instant mashed potato buds	13.75 oz.	\$ 2.45		Cardboard box
Instant mashed potato buds	1 lb. 12 oz.	\$ 3.75		Cardboard box
		\$		
		\$		
		\$		

1 lb. = 16 oz.



# ANALYZING THE COST AND PACKAGING OF A PRODUCT

Product	Package size	Price	Price/pound (lb).	How packaged
1.		\$	\$	
2.		\$	\$	
3.		\$	\$	
4.		\$	\$	
5.		\$	\$	
6.		\$	\$	

# BACKGROUND INFORMATION FOR THE TEACHER

There are many influences on what children buy—family food buying practices (e.g., buying fast foods, processed foods, frozen foods, fresh foods), advertising, packaging, socioeconomic factors, convenience, education, and beliefs. If children are to become responsible shoppers, there are many factors they should consider when they shop: (1) What kind of packaging does the food have? Is it necessary? Is it reusable? Is it recyclable? (2) What types of natural resources are consumed to create the packaging? Can these resources be recovered through reuse or recycling? and (3) What are the differences in the overall cost of foods? Food costs include such considerations as the amount of food in each package, the amount of packaging, and the comparative cost of disposing of waste versus reusing or recycling the package. Minimizing packaging material can make a big difference in the amount of solid waste that is produced.

At an early age children need to understand that when they buy something, they also buy the packaging. As responsible citizens they should see that the packaging of the products they buy is minimal, that it does not become litter, and that it is reused or recycled, if possible. If it is waste, they need to know how and where to dispose of it properly.

Packaging protects the contents from physical damage and spoilage and may also be used to ensure that the contents are sanitary. Labels on packaging identify contents and provide directions for use. Packaging may help retailers advertise their goods, keep sales records straight, and discourage theft. Packaging also provides consumer convenience.

By reducing spoilage and damage and by dividing food and beverages into individualized portions, packaging can actually reduce the volume of solid waste, because less food would be thrown away. Unfortunately, packaging also contributes substantially to the volume

of solid waste needing disposal, depletes natural resources, adds to litter and pollution, and increases the cost of a product. Most packaging is meant to be disposed after one use. Some packaging materials contribute nonbiodegradable or toxic materials to the environment. Most litter is packaging and includes cans, bottle, paper wrappers, and bags. This type of litter has adverse effects on tourism and may also harm or kill wildlife.

In the United States, packaging accounts for 50 percent of all paper produced, 90 percent of all glass, 11 percent of all aluminum, and 3 percent of all energy used. Packaging makes up about 50 percent by volume and 30 percent by weight of municipal solid waste.<sup>2</sup>

Excessive packaging typically increases the cost of products. If consumers can relate their purchase costs to the amount of waste generated by packaging, they will realize they can save money by purchasing products with less packaging and buying products in bulk.

Packaging's manufacturing, distribution, and retail process generally fails to account for the cost of package disposal. Since this cost is not included in the cost of the product, the product sells for less than it would if the cost for disposal were included. However, consumers do eventually pay for the costs associated with package disposal in the form of higher fees for garbage collection, landfill and incinerator operations, and the cleanup of litter. Without reusing or recycling packaging materials, the energy and natural resources that go into packaging are buried in landfills.

For more information on packaging, see "Appendix B-II, Waste Prevention."

<sup>2</sup>G. Tyler Miller, Jr. *Environmental Science: Working with the Earth* (Fifth edition). Belmont, Calif.: Wadsworth Publishing Company, 1995, p. 340.



- Students “select a focus, an organizational structure, and a point of view based upon purpose, audience, length, and format requirements.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 23)
- Students complete a chart on why people buy things and write in their journals how they can reduce the garbage they generate.
  - “Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings.” (*Mathematics Content Standards for*

*California Public Schools, Kindergarten Through Grade Twelve*, page 18)

## SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, relating

## TIME

20 minutes to prepare for the lesson; 90 minutes to implement each of the three parts of the lesson

## VOCABULARY

disposable, durable, sustainable, consumers

## PREPARATION

1. Read the “Background Information for the Teacher” at the end of this lesson.
2. Make a copy of the “Questionnaire for Why Do We Buy It?” (page 366).
3. Ask students to bring to class examples of one durable and one disposable item.

**Note:** Warn students not to bring potentially dangerous items to school, such as disposable razors. Check all items that are brought to class to make certain that they are appropriate for a classroom setting.

## MATERIALS

*For “Part I, Reading The Lorax by Dr. Seuss and Identifying Thneeds”*

\_\_\_ The book, *The Lorax*, by Dr. Seuss

*For “Part II, Completing a Questionnaire on Why People Buy Things”*

\_\_\_ A pencil and clipboard (or piece of cardboard) for each student

\_\_\_ The “Questionnaire for Why Do We Buy It?” for each student

*For “Part III, Analyzing Disposable and Durable Items”*

\_\_\_ Magazines and newspapers in which advertisements on disposable and durable products can be found

\_\_\_ Glue

\_\_\_ Five pieces of butcher paper or cardboard from boxes on which to glue collages

\_\_\_ Scissors

\_\_\_ Felt-tipped pens

## PRE-ACTIVITY QUESTIONS

In this lesson students will be focusing on non-food items that they purchase.

- A. Ask students what they believe are the main reasons why people buy products. List their ideas on the chalkboard. *To survive (e.g., food), for entertainment (e.g., videos), for protection (e.g., coat)*
- B. Ask students to think about and write down on a piece of paper a nonfood product that they recently discarded. Discuss with students:
  - Could this product have been reused or recycled? Why or why not?
  - Was it necessary to buy this product? Was it really needed? Explain.
  - What could have been done instead of buying the product and then throwing it in a trash can?

**Note:** Gather the pieces of paper on which students wrote the name of a product they recently discarded, and keep these to use in Lesson 6.

## PROCEDURE

### Part I, Reading *The Lorax* by Dr. Seuss and Identifying Thneeds

- A. Brainstorm with students what they think they need to live every day but are not necessary for survival. List these items on the chalkboard and save for the “Discussion/Question” section of this lesson.
- B. Tell students that they will hear or read a story called *The Lorax* by Dr. Seuss. They

Picture intentionally deleted.

Students from Nona Reimer's fifth-grade class at John Malcom Elementary School read *The Lorax* by Dr. Seuss.

should pay particular attention to what a *thneed* is.

1. Read or have students read *The Lorax* by Dr. Seuss.
2. Have students describe the plot of the story.
3. Ask students what was a *thneed*. A *thneed* is a thing that everyone thinks they need. (In *The Lorax*, the Once-ler explains, "A Thneed's a Fine-Something-That-All-People-Need.") Discuss with students that a *thneed* appears to be something that no one needs. On the other hand, however, a *thneed* appears to have many uses and, therefore, can be reused. (In *The Lorax* a *thneed* was described in the following way: "It's a shirt. It's a glove. It's a hat. But it has other uses . . .")
4. Divide the class into several groups.
  - Half of the groups will focus on the *thneed* as something that everyone thinks he or she needs but does not really need. Have these students create an advertisement to keep people from buying a *thneed*.
  - The other groups should focus on the *thneed* as being a great product that has many uses. Have them create an advertisement to encourage people to buy a *thneed*.
5. Ask groups to present their advertisements to the class.

A Thneed You  
NEED

You need a car to get around. It would be better to use a bike, but what would you do if you had to go to Sacramento? It would take double or more hours on a bike. So buy a car!

A Thneed  
You Don't  
Really Need

A lot of people think you need a computer, but actually you don't. It costs a lot, it'll keep you inside, and you can do a lot without a computer. So don't buy a computer unless you really need it.

Submitted by Connie Biehle, junior high school teacher, Ione Junior High School, Amador County Unified School District.

6. Ask students to describe in their journals at least two *thneeds* that they have at home. Have them describe one that is not really needed and one that is useful for many reasons.
7. Discuss what the Once-ler could have done to make his factory sustainable. You might need to explain to students that sustainable means to continue on and on and, in this case, to continue operating the factory without damaging the environment, including the natural resources that are being used.

## Part II, Completing a Questionnaire on Why People Buy Things

- A. Provide a copy of "Questionnaire for Why Do We Buy It?" to each student.
  - Ask students to complete columns "A" and "B" for two nonfood products they purchased in the past month.
  - Then ask students to complete columns "C" and "D" for two products that one of their classmates purchased in the past month.
  - Have students answer #1 for themselves and to ask a classmate to answer #2.
- B. After students have completed their questionnaires, discuss:
  - Which were the most common reasons for buying a product?
  - How frequently was packaging considered when purchasing an item? Why is that so?
  - Do most people appear to be concerned about waste disposal when deciding

Picture intentionally deleted.

A student from Janet Cohen's sixth-grade class at Gold Trail Elementary School asks another student why he buys certain products.

what to buy? *Usually not.* Explain your answer. *They do not know much about the problems of waste disposal.*

**Homework Assignment:** Assign students to interview their own families to find out why certain products were purchased for home use.

### Part III, Analyzing Disposable and Durable Items

- A. Discuss with students the definition of *disposable* and *durable* items. Note that *disposable* usually means one-time use, such as the use of a paper napkin, paper or polystyrene cup, or plastic container. However, there are some items that are considered disposable that may be used many times; e.g., a plastic container or a toothbrush.

**Note:** Since it is not always easy to determine whether an item is disposable, students will need to make their own judgments.

- B. Have students share the disposable and durable items that they brought to class.
- C. Brainstorm with the class a list of disposable products and record these on the chalkboard. Have students identify which disposables are used more often by adults than young people and which disposables young people use more often than adults. Discuss with students why disposable items are used and what types of disposable items are necessary. Ask them to give their reasons.

**Note:** In order to reduce solid waste, it is recommended that nondisposable items be used if substitutes for disposable items are available.

For example, students could carry their own reusable beverage containers. They might want to avoid aerosol cans, because these cannot be recycled, whereas a refillable pump spray could be reused. However, there are times when disposable items are essential, especially for personal health and safety reasons.

#### Disposable (One-time use)

- |                      |                      |
|----------------------|----------------------|
| • Contact lenses     | • Paper/plastic cups |
| • Paper plates       | • Disposable shavers |
| • Disposable cameras | • Cotton balls       |
| • Disposable diapers | • Toilet paper       |
| • Paper napkins      | • Charcoal           |
| • Light bulbs        | • Books              |
| • Garbage bags       | • TV dinner trays    |

#### Durable (Can be used more than once)

- |                          |                 |
|--------------------------|-----------------|
| • Shovels                | • Sunglasses    |
| • Regular cameras        | • Paper bags    |
| • Jars                   | • Plastic bags  |
| • Plastic bottles        | • Backpacks     |
| • Rechargeable batteries | • Water bottles |
| • Shoes                  | • Books         |
| • Clothes                | • Cloth towels  |

Submitted by Tina Porter's science class, Curtner Elementary School, Milpitas Unified School District.

- D. Have each student select one of the products listed on the chalkboard.
- Ask students to write narratives in their journals that describe the advantages and disadvantages of buying this disposable product. Then they should decide whether they would buy this product and explain their reasons.
  - Explain to students that they should organize their writing to make their point of view clear to their audience (groups of students in their class). They should write at least three paragraphs.
  - When students have completed their narratives, ask them to share these in small groups.
- E. Discuss with students:
- On what occasions do we tend to use the most number of disposable products? *On a picnic we use paper plates, paper napkins, and plastic forks; when we have a cold, we might use more facial tissue paper;*

for birthday parties we tend to use wrapping paper for gifts.

- What disposable items could be replaced with durable ones? *Paper plates, paper cups, paper napkins, paper lunch bags, tissue paper, plastic wrap.*
  - Why should using nondisposable items be encouraged? *Less waste will be sent to the landfill and fewer natural resources will be needed, because nondisposable items are being reused.*
  - When are disposable items essential? *If the health and safety of a person is a concern.*
- F. Divide the class into five groups. Provide several magazines and newspapers to each group. Assign one of the following tasks to each group:
- Task 1.** Look for advertisements that contain the word *disposable* and locate pictures of items that are disposable (e.g., make-up). Cut out the advertisements and pictures.
- Task 2.** Look for advertisements that mean *durable* (e.g., well-built and long-lasting) and locate pictures of items that are durable (e.g., wooden bench, jeans). Cut out the advertisements and pictures.
- Task 3.** Locate pictures of containers that could be reusable and cut out the advertisements. How could these be reused?
- Task 4.** Locate pictures of things that people think they need but can probably live without.
- Task 5.** Locate pictures of items or products that people must have to survive.
- G. Have groups make collages of what they gathered from magazines. They should label their collages and present these to the class.

**Note:** Another way to do this is to select only one or two tasks for all groups to complete.

**Homework Assignment:** Allow students to choose one of the following:

- Select a part of your day (e.g., getting ready in the morning) and describe it in writing. List items you used at that time of the day. Of those items you listed, select which would be considered disposable and which durable. What disposable items could be replaced with durable ones?

- Look at home for items that are disposable. List these. Look for items that are durable. List these. Select a disposable item and list ways this item can be reused. How can fewer numbers of this item be purchased in the future?

- H. Ask students to share their homework assignments.

## DISCUSSION/QUESTIONS

- A. Discuss with students:

- What were the needs that we had at the beginning of this lesson? Are there any needs that were not necessary? What changes would you make to the list we developed at the beginning of this lesson?
- Why might we want to try to cut back on buying things we do not really need? *By cutting back, we can save natural resources.*
- How does what we purchase affect the number of natural resources and the amount of energy used? *The more we buy, the more natural resources and energy are needed to replace what we bought.*
- Is it better for the environment to buy high quality products (probably expensive) that will last a long time or low quality (probably less expensive) products that need to be replaced often? *High quality products, if you take care of them.*
- Besides cutting back on your buying, people can also practice garbage reduction by not wasting things. How can we cut back on wasting things? *Use one facial tissue instead of two or three facial tissues or use a handkerchief; use a refillable thermos bottle for drinks instead of cans or disposable cups; give a magazine you have finished reading to someone else instead of throwing it away or recycling it.*
- What can we consider when buying things to make sure that we are conserving natural resources, such as trees and fossil fuels? *If safe, buy unwrapped products or products with less packaging; buy fewer products; don't buy what you don't really need; buy things that will last; take care of what we have.*

- B. Refer to the list developed in the "Pre-Activity Questions." Discuss how the packaging

of a product can make you want to buy it. What questions can we ask ourselves to make sure that we are buying wisely? Record students' responses on the chalkboard. For example:

- Why did I buy it?
- Do I really need this?
- Is this a disposable product?
- Will what I buy create waste? How much garbage will I have to throw away?
- Does it have too much packaging? Is there unnecessary packaging used to advertise the product?
- Is the product and the packaging made from recycled material?
- Will it go out of fashion soon?
- Will I use it for a short while and then get bored with it?
- Will it break easily?
- Is this a quality product and will it last a long time?
- How much energy and how many natural resources were used to manufacture this product?
- Can I buy this product at a second-hand store?
- Could I borrow this product instead of buying it?

## APPLICATION

- A. Ask students to describe what informed consumers do concerning the purchases they make. *Informed consumers care about reducing the amount of garbage they create and use good judgment when buying products. They buy durable products, don't buy what they don't really need, and limit what will become trash after one use.*
- B. Ask students to work in groups and develop a list of criteria that informed consumers can follow when making a decision about what to buy. For example, whenever possible, buy products that (refer to the list developed in "Discussion/Questions" section "B"):
- Will last a long time
  - Are packaged in recyclable, returnable, or refillable containers

- Are not overpackaged
- Are not one-time-use disposables (unless health or safety is compromised)
- Can be repaired easily

- C. Ask students to describe in their journals the following:
- What products are you planning to buy in the future?
  - How could you reduce the number of products you purchase?
  - In order to reduce waste, what could you consider before buying something?

**Homework Assignment:** Ask students to keep a log for the next month of what they buy. They should answer the following questions for each product they buy.

1. Why did I buy it?
2. Do I really need it?
3. Will buying it create waste?
4. Is it disposable?
5. Will it break easily?
6. How long am I planning to use it?

- D. Over the next month ask students to report what they have found out about their buying habits.

## EXTENSIONS

- A. Have students develop a questionnaire about why people buy things and have them conduct some interviews at school and at home. Have them develop a graph showing the most popular reasons why people buy things.
- B. Have students gather and compare costs and the life span of comparable disposable and nondisposable items.

## RESOURCES

### Videos

*Going Green: How to Reduce Your Garbage.* Oley, Pa.: Bullfrog Films, 1994 (22 minutes).

Provides a step-by-step guide to reducing garbage. A family shows practical ways to reduce waste. Describes easy methods of sorting recyclables, alternatives to common household hazardous chemicals, and the benefits of composting and of buying in bulk. Grades five through adult.



*Reduce*. Protecting Our Environment series. Chatsworth, Calif.: Pied Piper/Aims Media, 1992 (14 minutes).

Provides suggestions on how to reduce the amount of waste that is thrown away. Explains how overpackaged and disposable items create excess trash and waste energy and natural resources. Also available in Spanish. For grades four through six.

### Books

Kalman, Bobbie. *Reducing, Reusing, and Recycling*. The Crabtree Environment series. New York: Crabtree Publishing Company, 1991.

Explains to students the importance of and offers recommendations for ways students can reduce, reuse, and recycle.

Seuss, Dr. *The Lorax*. New York: Random House, Inc., 1971.

Tells in verse the story of overharvesting a natural resource to create a product of questionable need to society. Offers hope to children in reestablishing the natural resource (trees) in the area.

Picture intentionally deleted.

One child interviews another about why she buys things. Photo taken at the Solar Community Housing Association, Homestead CO-OP.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## QUESTIONNAIRE FOR WHY DO WE BUY IT?

Complete columns A and B for the two products you purchased in the past month. Complete columns C and D for two products a classmate purchased in the past month. Place a check mark in any box that describes a reason why the product was bought.

Reason product was bought	A Name of product: _____	B Name of product: _____	C Name of product: _____	D Name of product: _____
1. The cost				
2. Saw it advertised				
3. Because packaging is reusable/recyclable				
4. Trying something new				
5. Catchy packaging; visually attractive				
6. Recommended by a friend				
7. Was on sale				
8. Uses less packaging than other brands				
9. Familiar with the brand				
10. Bought this product before				

### Answer #1 for yourself

1. When you buy a product, do you think about whether its package can be reused or recycled?    Yes    No    Sometimes

Explain your answer: \_\_\_\_\_

### Ask your classmate to answer #2 and record the answer.

2. When you buy a product, do you think about whether its package can be reused or recycled?    Yes    No    Sometimes

Explain your answer: \_\_\_\_\_

# LESSON 5: Why Do I Buy It?

## LESSON'S CONCEPTS

- Practicing waste prevention is an effective way to cut down on solid waste.
- An individual's informed and careful buying decisions, which include considering waste disposal and recycling, can significantly reduce the volume of household waste.
- Solid waste contains increasingly more disposable (one-time use) objects and synthetic materials.
- If people reduce the number and types of goods they purchase, fewer goods will need to be manufactured and fewer natural resources will be used.

## PURPOSE

Students will learn that informed buying is the first step in reducing the amount of solid waste and will find out the reasons why they and their classmates buy certain products.

## OVERVIEW

In this lesson students will:

- Listen to or read *The Lorax*, by Dr. Seuss.
- Develop advertisements for products that are not really needed and for products that have many uses.
- Identify some of these products as they pertain to their lives.
- Complete a questionnaire on why they and their classmates buy things.
- Work in groups to analyze disposable and durable items.
- Develop a criteria for selecting and purchasing products which use less energy and fewer resources.
- Keep a log of what they buy and analyze their purchases.

## CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students read *The Lorax* by Dr. Seuss and identify how overharvesting a natural resource in order to produce a product can deplete the natural resource.

- Students "identify the main events of the plot, their causes, and the influence of each event on future actions." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 22)
- Students "identify the main problem or conflict of the plot and explain how it is resolved." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 29)
- Students create advertisements for a *thneed*.
  - Students "choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 37)
- Students compare disposable to durable products and develop a criteria for selecting and purchasing products which waste less energy and use fewer resources. They write a narrative on the advantages and disadvantages of disposable products.
  - "In making decisions, it helps to take time to consider the benefits and drawbacks of alternatives." (*Benchmarks for Science Literacy*, page 165)

# BACKGROUND INFORMATION FOR THE TEACHER

According to the U.S. Environmental Protection Agency, each American throws away about four to seven pounds of waste per day. As landfill capacity diminishes and environmental concerns and public perceptions restrict or delay the construction of new facilities, new strategies are being developed to address solid waste. Most people, when asked what they can do to reduce their waste, answer, “I can recycle!” Recycling has become popular among local governments, businesses, and citizens as a method to divert valuable materials from landfills. However, recycling does not reduce the amount of waste actually generated. Preventing waste from being created in the first place—waste prevention (reducing and reusing)—is the preferred method. After all, waste that does not get produced does not have to be managed. Furthermore, waste prevention eliminates the need for handling and transporting materials, eliminates the energy-intensive remanufacturing step which is required in recycling, conserves natural resources and energy, reduces waste management costs, reduces pollution, and encourages innovation. For these reasons, waste prevention is the highest priority in the California Integrated Waste Management Board’s (CIWMB) hierarchy for the management of solid waste.

To encourage waste prevention actions by consumers and industry, the California Legislature mandated the CIWMB to develop strategies to promote waste prevention within the public and private sectors. The CIWMB evaluated strategies

which include (1) legislative actions to promote waste prevention; (2) actions to improve packaging and product design; (3) actions to develop and implement product durability standards; and (4) actions to reduce toxicity of packaging and products.

Currently, Americans live in a disposable society—one in which many manufactured products are designed for a single use and are then disposed. Waste prevention encourages the production processes and consumer choices that are efficient and conserve natural resources.

Consumers are people who buy things. In California there are over six million children who are current and future consumers and waste generators. Through education these children can learn responsibility for their consumptive behavior, as well as ways to influence adults to be more aware of purchasing choices. By providing insight into purchasing choices and the consequences resulting from these choices, children can become wise consumers, who help to reduce solid waste and conserve natural resources.

Whether at home, school, work, or elsewhere, waste prevention is something everyone can practice. People who practice waste prevention eliminate waste wherever possible in the products or packaging that they buy and use. They also reuse whatever they can. And, when possible, they purchase items made from recycled materials.

# LESSON 6: Reusing Trash

## LESSON'S CONCEPT

Reusing products helps reduce waste and conserve natural resources and landfill space.

### PURPOSE

Students will discover that some products can be easily reused to extend their use, therefore reducing the amount of solid waste to be placed in landfills.

### OVERVIEW

In this lesson students will:

- Participate in guided imagery to focus on how an item can be reused.
- Brainstorm ways a milk carton can be reused and then work in groups to design new uses for two milk cartons.
- Listen to or read *Galimoto* by Karen Lynn Williams and describe the efforts of the boy in the story to reuse wire to make a toy.
- Provide examples of items they can gather to make a new item.
- Participate in two skits about reusing materials and write additional parts to the skits.
- Select an item at home that would have been thrown away, reuse it in a creative way, and bring the item to class or write a description of how the item was reused to share with class members.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students design new uses for milk cartons.
  - "Some materials can be used over again." (*Benchmarks for Science Literacy*, page 188)

- "Discarded products contribute to the problem of waste disposal." (*Benchmarks for Science Literacy*, page 189)
- Students read *Galimoto* by Karen Lynn Williams and describe the efforts of the boy in the story to reuse wire which he acquires from many different sources to make a toy.
  - "Students read and respond to a wide variety of significant works of children's literature." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 22)
- Students participate in two skits about reusing, and write additional parts to the skits.
  - "Students convey the emotional qualities of given characters through simple dramatizations." (*Visual and Performing Arts Framework, Theater Education: Creative Expression Component, Goal 3, kindergarten through grade four*, page 83)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, relating

### TIME

30–45 minutes to prepare for the lesson; 90 minutes to implement each of the three parts in the lesson

### VOCABULARY

Ask students to select vocabulary words from the book *Galimoto* by Karen Lynn Williams.

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. Copy and cut apart “Ways to Reuse Items” (pages 378-381).
- 3. Copy the skits, “The Funnels” (pages 375 and 376) and “Jobs for Bags” (page 377), for each student. To save paper, the skits can be copied in duplex form (on both sides of the paper) and then reused every year.

## MATERIALS

### *For “Part I, Making Items Out of Milk Cartons”*

- Two ½-gallon milk cartons or two 1-gallon plastic jugs for each group of students (Wash and dry the cartons or jugs thoroughly.)
- A variety of arts and crafts materials, including glue, scissors, yarn
- A variety of discarded items that can be reused in the milk carton projects, such as scraps of material, scraps of paper, straws

### *For “Part II, Reading Galimoto by Karen Lynn Williams”*

- The book, *Galimoto* by Karen Lynn Williams

### *For “Part III, Reading and Acting Out Two Skits About Reusing”*

- A copy of the skits, “The Funnels” and “Jobs for Bags,” for each student
- Two funnels (available at auto stores and kitchen supply stores or by making your own by cutting the bottom half off a gallon jug and turning the top upside down)
- Three brown grocery bags

### *For “Application”*

- A copy of “Ways to Reuse Items”

## PRE-ACTIVITY QUESTIONS

- A. Lead students on an imaginary tour of solid waste going from a curbside trash can to a landfill. Tell students to select a nonfood item that often goes to the landfill. For example, a lawn chair that has a broken seat. Narrate the following to students: “Sit comfortably at your desk and close your eyes. Imagine the day when your neighborhood’s trash is being picked up. Think about the nonfood item that you selected that often ends up in the trash. Follow this item to the

landfill. Watch how this item is dumped in the landfill. What other items do you see in the landfill? What might happen to your item? Will it ever be used again? Now pretend that your item was taken to a place called Reuse Town, instead of the landfill. See people there repairing items. How can your item be repaired? If your item cannot be or does not need to be repaired, how can it be reused or changed so that it can be used again? Your item is now for sale at a secondhand store. Someone is looking at it and is going to buy it. Who buys it? Is the person excited to own this item? Think about how this item’s use was extended. When you are ready, open your eyes.”

- B. Ask students to write in their journals about their guided imagery experience. Their entries should include:
- The names of their items
  - The names of other items they imagined seeing in the landfill
  - How their items were prepared for reuse (For example, a lawn chair with a broken seat had the seat repaired or replaced. A toy was washed. A strawberry basket was made into a notepad holder.)
- C. Ask students to share their journal entries. This sharing can be done in small groups.
- D. Discuss with students the meaning of *reuse*. *To use again for the same purpose or for a different purpose.* What are some examples of ways items can be reused? *Using plastic margarine containers for leftovers; handing down clothes from an older to a younger sister or brother.*
- E. Show a ½-gallon milk carton to the class. Ask students to brainstorm ways this milk carton can be reused. List these on the chalkboard. Have students include a list of items from which the carton can be made.

## PROCEDURE

**Note:** The purpose of this activity is to reuse objects, not to create more waste. Therefore, ask students to use as much of the reusable material as possible and/or to use other students’ scraps. At the end of the activity, they should place in a “reuse” box, items that can be reused, and place in a “recycle” box, items that can be recycled.

## Part I, Making Items Out of Milk Cartons

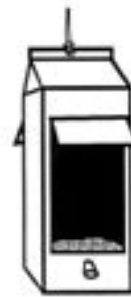
- A. Provide two ½ -gallon milk cartons or two 1-gallon plastic jugs to each group of students. Ask them to make two separate items from these containers. Several ideas are described below. Encourage students to come up with their own creations. This can include games and holders for various items. The following describes ways to use ½ -gallon milk cartons. Students can adapt the directions if they are using 1-gallon jugs.

- **Milk carton birdhouse:**

Cut a 1-inch hole in the side of the carton about 2 inches from the bottom. Cut a slit below the entrance and slip through the slit a piece of dowel or a popsicle stick for a perch. Punch two holes in the top of the carton and slip a piece of yarn or heavy string through. Tie the carton to a tree branch.



- **Bird feeder:** Cut opposite sides of the carton back 1½ inches from the bottom. Trim under the gable to make the roof overhang. Use a plastic straw or dowel for a perch. Punch a hole in the top of the milk carton and hang from a branch or eave or nail directly to a post. Fill the bottom with birdseed.



- **Holder (such as a pencil holder or a car litter box):** Cut the milk carton to desired height. Cover the outside with cloth scraps by overlapping the cloth and gluing the cloth to the milk carton. If you can find self-adhesive paper that someone wants to get rid of, use it to cover the milk carton. (Since this is an activity in reusing materials, do not buy the paper unless it is for sale at a secondhand store.)
- **A box for jewelry or photographs:** Glue colored scrap paper or cloth on the milk carton. Cut the carton to make a hinge.
- **A planter:** Punch holes in the bottom of the milk carton. Decorate the carton. Add gravel on the bottom. Place soil on top of

the gravel and put a plant in the soil.

- Other items made by students. For example, mini-dollhouse, bank, gift boxes, candy dispenser, pet dish, football board game.

- B. Allow time for groups to complete their projects. Then ask students to present their creations to the class.

## Part II, Reading *Galimoto* by Karen Lynn Williams

- A. Have students read *Galimoto*, by Karen Lynn Williams, in pairs or small groups. If you have only one book, students can take turns reading it in pairs or as a class. You could also read the book to them.
- B. Discuss the story, *Galimoto*.
- What were the sequence of events? *Kondi shared with his brother that he wanted to make a galimoto (which is a toy vehicle made of wire). His brother laughed and said that he was too young and didn't have enough wire to make it. Kondi didn't give up and went to different people to get the wire he needed. Eventually, he got enough wire and made a galimoto.*
  - What were the efforts of the boy in the story to acquire wire? *He asked many different people in order to collect enough wire.*
  - What types of things could students make that will require the gathering of items no longer being used? Encourage students to name things other than those they made in "Part I" of this lesson.

## Part III, Reading and Acting Out Two Skits About Reusing

- A. Have students read and act out one or both skits: "The Funnels" and "Jobs for Bags."
- B. Separate students into groups of two or three, and have each group write one more scene to either of the two skits.
- For "The Funnels" skit, students can come up with more scenes for the play or select a different item which is often discarded.
  - For "Jobs for Bags" skit, encourage students to come up with other uses for the paper bags. Students could also rewrite "Jobs for Bags," describing plastic or cloth bags instead of paper.

Picture intentionally deleted.

A students from Oak Valley Elementary School cuts a milk jug to make a pet dish.

Additional scene for “The Funnels”:

*Scene VI*

*Maria went back to her house. She called her sister but there was no answer. She held the funnel close to her mouth and called her sister again. Her sister answered and said, “Your voice sounds loud.”*

Additional script to “Jobs for Bags”:

**Group of Protesters:** *Yes, it can be used for a hood, like when it rains.*

**Employment Person:** *I like that job, but is there any kind of job aside from that hood thing?*

**Protester 1:** *I have another idea. I can be a puppet.*

**Employment person:** *Excellent! This could be a great entertainment for the little kids. We will need plenty of this, so we will hire all of you!*

Submitted by Joanne Williams’s sixth-grade class, Las Palmas Elementary School, National School District.

- C. Encourage students to act out the skits, adding scenes that they wrote.

**Homework Assignment:** Ask students to write additional scenes to one of the skits, or they can write their own skit.

- D. Encourage students to perform a classroom dramatization of their writings.

Picture intentionally deleted.

Students from Janet Cohen’s sixth-grade class at Gold Trail Elementary School make a pencil holder from a plastic milk container.

## DISCUSSION/QUESTIONS

- A. What do we gain by reusing materials (i.e., how do we benefit by reusing materials)?  
*Less trash ends up in the landfill; energy and natural resources are conserved.*
- B. What types of things do people throw away that can be reused? *Plastic containers, clothes, books, furniture, toys, games.*
- C. What types of things do you throw away that can be reused?
- D. Which action conserves natural resources more: reusing or recycling? Explain your answer. *Reusing, because when an item is reused, it does not need to be collected by a recycling company, and energy will not be needed to make a new product.*

## APPLICATION

- A. Ask students to describe in their journals two things that they will do differently from now on, based on what they have learned in this lesson.
- B. Randomly distribute to students the pieces of paper on which students wrote (in Lesson 4) the name of a nonfood item that they recently discarded. Each student should have someone else’s paper. Ask students to read the item to the class and describe two ways that this item could be reused.



C. Divide the class into seven groups.

- Assign a letter (A through G) to each group and give each group the corresponding section from “Ways to Reuse Items.” This list contains household items that can be reused in some way.
- Ask students to write next to each item at least two ways the item can be reused.
- Have students select two items from their lists and share their responses with the class.

*Baskets—make gift baskets or use it to carry things in.*

*Boards and bricks—make a fort or a fence.*

*Cardboard tubes—make rain sticks or binoculars.*

*Clay—make ornaments or a toy.*

*Coat hanger—make a wind vane or mobile.*

*Clothes—give them to someone who needs them or if they are too old, make puppets or costumes out of them.*

*Egg carton—decorate the outside and use it to hold jewelry or a rock collection.*

*Yarn, string, or rope—use to tie a sleeping bag or to tie other things.*

Submitted by Janet Cohen’s sixth-grade class,  
Gold Trail Elementary School, Gold Trail Union  
School District.

**Homework Assignment:** Ask students to select an item at home that will be thrown away. They should make something out of the item so that the item will be reused. Encourage students to bring their reused items to class or to write a description of the item.

**Project Idea:** Have students make toys out of reused materials to give to younger students.

## EXTENSIONS

A. Recycle Christmas trees.

- During January and February, prop a Christmas tree near a bird feeder to provide cover for birds during cold months. The tree should be positioned near the feeder, but not close enough for a cat or other predator to climb up to where birds are feeding.
- Use branches from the tree as mulch for flower beds.
- Collect needles and make art pieces.
- Have students come up with additional

ideas for reusing the entire tree or parts of a tree. Make sure that they take into consideration any fire hazards.

- If pine cones are available, roll these in lard and then in birdseed. Hang the pine cones on the tree to provide food for woodpeckers.

B. Collect the craft paper that is wrapped around reams of paper at your school or district office. Have students invent uses for these wrappers (e.g., make book covers, cover a bulletin board).

C. Make lanterns.

- Fill coffee cans with water and freeze. (The ice will prevent cans from bending when holes are punched.)
- Have students draw designs on paper; then tape the designs to the cans. Have an adult use a hammer and nails (varying sizes of nails can be used) to punch the design.
- Remove the ice from the coffee can, or wait until it melts and pour the water out.
- Glue or screw on a bottle cap in bottom of the can to hold a candle.
- Bend a wire coat hanger to hang the lantern.
- Provide fire safety information to students.

D. Visit an art display that reuses discarded materials. Plan a similar class art display.

E. Present the skits, “The Funnels” and “Jobs for Bags,” to another class or at a school assembly.

## RESOURCES

### Video

*Reuse.* Protecting Our Environment series. Chatsworth, Calif.: Pied Piper/ Aims Media, 1992 (13 minutes).

Shows how household items can be reused. Includes information on how to reuse yard trimmings, containers, and appliances. Also available in Spanish. For grades four through six.

### Books

Ashley, Cynthia, and Sylvia Velazques. *Creative Reuse Extravaganza: A Festival of Games, Crafts, and Fun Using Discarded Materials*. Oakland: East

Bay Depot for Creative Reuse, Inc., 1996.

Provides descriptions of projects for students that allow them to use materials that are usually thrown into a garbage can.

Brackett, Karen, and Rosie Manley. *Beautiful Junk: Creative Classroom Uses for Recyclable Materials*. Columbus, Ohio: Fearon Teacher Aids, 1990.

Contains activities about recycling.

Harlow, Rosie, and Sally Morgan. *Garbage and Recycling*. Young Discoverers series. New York: Larousse Kingfisher Chambers, Inc., 1995.

Provides information about reusing, recycling, packaging, litter, and worms. Recom-

mends activities for students to learn more about the solid waste problem and how to help solve it.

Schwartz, Linda. *Likable Recyclables: Creative Ideas for Reusing Bags, Boxes, Cans, and Cartons*. Santa Barbara, Calif.: The Learning Works, Inc., 1992.

Shows ways to reuse bottles and cans.

Williams, Karen Lynn. *Galimoto*. Illustrated by Catherine Stock. New York: William Morrow & Company, Inc., 1990.

Describes the efforts of a boy who collects and trades for pieces of wire to make a toy.

# THE FUNNELS

**Note:** The original script for “The Funnels” was written by teachers at the Foothill Horizons Teachers Retreat on April 18, 1997, sponsored by the San Joaquin County Office of Education. The following is an edited version.

## Characters:

- Maria
- Bob, an older person
- Bill, a younger person
- Kathy
- Mark
- Leann
- Bruce
- John
- Kim

**Props:** Two funnels

## Scene I

Maria walks out carrying two funnels. She tosses them into the trash can and sits down on a bench near the trash can.

Maria observes . . .

## Scene II

Bob, an older person, and Bill, a younger person, walk up and stand next to the trash can. Bill says in a normal voice, “Why did the chicken cross the road on a bicycle again?”

Bob, holding a hand up to his ear replies, “Eh, what did you say?”

Bill repeats the question louder.

Bob, holding a hand up to his ear replies, “Huh, I can’t hear you.”

Bill reaches into the trash can and pulls out a funnel and hands it to Bob. Bob puts it up to his ear.

Bill says, “Why did the chicken cross the road on a bicycle again?”

Bob replies, “I don’t know. Why did the chicken cross the road on a bicycle again?”

Bill answers, “Because he wanted to RECYCLE.”

The two put the funnel in the trash can and walk off laughing.

Maria laughs.

### Scene III

Kathy and Mark walk out laughing and dancing. They look in the garbage can and pull out the funnels. They each place a funnel on their heads and begin counting down, “Five, four, three, two, one—Happy New Year!” Then they take the funnels off their heads and turn them over and yell through them, “Happy New Year!” They put the funnels in the trash can and walk off.

Maria smiles.

### Scene IV

Leann and Bruce walk out. Bruce is coughing. Leann reaches into the trash can and pulls out a funnel. Leann says, “You really need to take your medicine.” Then Leann holds the funnel up to Bruce’s mouth and pretends to pour medicine into it.

Bruce says, “Wow, my cough is gone. Thank you, Leann.”

Leann says, “You are welcome.” They put the funnel back in the trash can and walk off.

Maria is watching closely.

### Scene V

John and Kim walk up and pick up the funnels. John holds the pointed ends up to his eyes like binoculars and looks all around as if looking at birds. He hands the funnels to Kim, who looks through them. Kim then places the funnels back in the trash can. Both walk off.

Maria then stands up and walks over to pick up the funnels. She looks them over and says, “Wow, these have so many uses. I didn’t need to throw them away!” She walks off admiring the funnels.

# JOBS FOR BAGS<sup>1</sup>

## Characters:

- Employment Person with sign, “Employment Office”
- Group of protesters
- Protester 1, carrying a brown grocery bag containing a hat made from a brown paper bag
- Protester 2, carrying a brown grocery bag containing a mask made from a brown paper bag
- Protester 3, carrying a brown grocery bag containing a book cover made from a brown paper bag

The Employment Person walks out with a sign that says “Employment Office.”

A group of protesters walk out; three are carrying paper bags. All are yelling, “Jobs for bags! Jobs for bags!”

Protesters circle the Employment Person and then line up on both sides.

**Employment Person:** “Can I help you?”

**Protester 1:** “We are looking for jobs for paper bags.”

**Employment Person:** “I am sorry but we don’t have any jobs for bags.”

**Protester 2:** “But you must have something.”

**Employment Person:** “No, I just don’t have any jobs for bags. All bags can do is hold items, and we don’t have any requests for holding items.”

**Protester 3:** “But bags have so many other uses.”

**All Protesters:** “Yeah, bags have many uses.”

Protester 1 pulls out a paper hat from a brown grocery bag and places it on his or her head.

**Protester 1:** “See, I can be a hat.”

**Employment Person:** Well, actually we do have a job for a hat at the community garden.

Protester 2 pulls out a mask from a brown grocery bag and places it on his or her face.

**Protester 2:** “I can be a cool mask.”

**Employment Person:** A mask? Yes, the community theater is looking for a mask.

Protester 3 pulls out book cover from a brown grocery bag and pulls out a book cover.

**Protester 3:** “I can be a book cover.”

**Employment Person** (getting excited): “Great! Our local school needs book covers. They can hire at least ten of you.”

All protesters cheer.

**Employment Person** (asks the audience): “Do you know any other jobs that paper bags can do?”

<sup>1</sup>Idea from “As the Bag Is Reused,” written by teachers at the Foothill Horizons Teachers Retreat, April 18, 1997, sponsored by the San Joaquin County Office of Education.

# WAYS TO REUSE ITEMS

Names: \_\_\_\_\_

## Group A

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Aluminum pie tins \_\_\_\_\_  
\_\_\_\_\_
- Appliance boxes or crates (large) \_\_\_\_\_  
\_\_\_\_\_
- Baskets \_\_\_\_\_  
\_\_\_\_\_
- Bottle caps \_\_\_\_\_  
\_\_\_\_\_
- Buttons \_\_\_\_\_  
\_\_\_\_\_

Names: \_\_\_\_\_

## Group B

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Cardboard tubes \_\_\_\_\_  
\_\_\_\_\_
- Clothes (dresses, socks, costumes) \_\_\_\_\_  
\_\_\_\_\_
- Coat hangers \_\_\_\_\_  
\_\_\_\_\_
- Corks \_\_\_\_\_  
\_\_\_\_\_
- Cardboard \_\_\_\_\_  
\_\_\_\_\_
- Egg cartons \_\_\_\_\_  
\_\_\_\_\_

Names: \_\_\_\_\_

**Group C**

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Electronic equipment scraps \_\_\_\_\_  
\_\_\_\_\_
- Envelopes and manila folders (used) \_\_\_\_\_  
\_\_\_\_\_
- Fabric scraps \_\_\_\_\_  
\_\_\_\_\_
- Games and puzzles \_\_\_\_\_  
\_\_\_\_\_
- Greeting cards \_\_\_\_\_  
\_\_\_\_\_
- Juice cans (small frozen type) \_\_\_\_\_  
\_\_\_\_\_

Names: \_\_\_\_\_

**Group D**

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Kitchen utensils \_\_\_\_\_  
\_\_\_\_\_
- Magazines \_\_\_\_\_  
\_\_\_\_\_
- Maps \_\_\_\_\_  
\_\_\_\_\_
- Meat and produce polystyrene trays \_\_\_\_\_  
\_\_\_\_\_
- Nylon stockings \_\_\_\_\_  
\_\_\_\_\_

Names: \_\_\_\_\_

**Group E**

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Toothbrushes (rinse in bleach first) \_\_\_\_\_  
\_\_\_\_\_
- Paper bags \_\_\_\_\_  
\_\_\_\_\_
- Plastic bags \_\_\_\_\_  
\_\_\_\_\_
- Pillows and cushions \_\_\_\_\_  
\_\_\_\_\_
- Plastic containers (margarine tubs, bleach bottles, squeeze bottles) \_\_\_\_\_  
\_\_\_\_\_
- Popsicle sticks \_\_\_\_\_  
\_\_\_\_\_

Names: \_\_\_\_\_

**Group F**

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Ribbons \_\_\_\_\_  
\_\_\_\_\_
- Rubber bands \_\_\_\_\_  
\_\_\_\_\_
- Rug and carpet pieces \_\_\_\_\_  
\_\_\_\_\_
- Strawberry boxes and baskets \_\_\_\_\_  
\_\_\_\_\_
- Straws \_\_\_\_\_  
\_\_\_\_\_



Names: \_\_\_\_\_

### Group G

Listed below are items that can be reused in some way. Write next to the names of the items at least two ways the items can be reused.

- Sturdy boxes \_\_\_\_\_  
\_\_\_\_\_
- Styrofoam packing material \_\_\_\_\_  
\_\_\_\_\_
- Wallpaper leftovers and wallpaper books \_\_\_\_\_  
\_\_\_\_\_
- Wire screen and chicken wire \_\_\_\_\_  
\_\_\_\_\_
- Wood scraps and pieces \_\_\_\_\_  
\_\_\_\_\_
- Yarn or string or rope \_\_\_\_\_  
\_\_\_\_\_

# BACKGROUND INFORMATION FOR THE TEACHER

Reusing an item is more energy efficient and conserves more natural resources than recycling, because the item does not need to be shipped anywhere and remanufactured into another product. For example, if a family goes to the local co-op and buys bulk peanut butter, placing it in a glass jar they already have, one fewer glass jar is made, which saves the energy and materials needed to produce that glass jar. In addition, the family is reusing the glass jar they already had; therefore, that jar stays out of the waste stream, does not fill up the landfill, does not have to be collected by recycling crews, and does not use the energy it would have taken to remanufacture it into a new product.

There are dozens of other ways that common discards can be reused. An awareness of the possibilities, a gradual rejection of the “disposable” ethic, and persuasion of manufacturers to make fewer disposable and more reusable products are needed.

Many individuals and organizations have found creative ways to reuse items, such as refinishing

old doors for remodeling projects, using odds and ends in sculptures and stage sets, and manufacturing used sails into cloth bags and clothing. They also give, share, or trade items they no longer want with others who can use them.

The California Integrated Waste Management Board’s (CIWMB) CALMAX program allows businesses to exchange or purchase each other’s discarded materials. The CIWMB also sponsors a KidMAX program in which items are donated by individuals and businesses, which can be acquired by teachers. For more information visit the following websites:

[www.ciwmb.ca.gov/calmax/\(CalMAX\)](http://www.ciwmb.ca.gov/calmax/(CalMAX))

[www.ciwmb.ca.gov/calmax/kidmax.htm\(KidMAX\)](http://www.ciwmb.ca.gov/calmax/kidmax.htm(KidMAX))

Also see “Appendix B–II, Waste Prevention,” which includes a section on sources for free and lower cost reusable items.

# LESSON 7: Plastic Polymers

## LESSON'S CONCEPTS

- Properties of different plastics can be identified.
- Some plastics can be reused or recycled.

### PURPOSE

Students examine the physical properties of different types of plastic and learn ways to reuse plastic products.

### OVERVIEW

In this lesson students will:

- Conduct a series of tests to determine the properties of different types of plastics.
- Test plastics for decomposition by burying them for several weeks.
- Develop a rubric for assessing the value of their invention of new uses for a plastic item.
- Invent new uses for a plastic item.
- Audit the plastic waste generated in their homes.
- Identify new practices which would generate less plastic waste.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students compare the properties of plastics and classify them according to resin type.
  - "Many forms of matter are identifiable by their color, texture, or shape; by their hardness or flexibility . . ." (*Science Framework*, page 41)
  - "Through science and technology, a wide variety of materials that do not appear in nature at all have become available . . ." (*Benchmarks for Science Literacy*, page 188)

- Students "classify objects . . . based on appropriate criteria." (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 6a*)
- Students "analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns." (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 19)
- Students invent new uses for a plastic item.
  - "Students create original artworks based on personal experiences or responses." (*Visual and Performing Arts Framework, Visual Arts Education: Creative Expression Component, Goal 4*, page 101)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying, relating

### TIME

30 minutes to prepare for the lesson; 90 minutes to implement each of the three parts in the lesson, plus time throughout the week for students to work on their inventions; and 45–60 minutes after the decomposition test is completed (about three months later)

### VOCABULARY

plastic, polymer

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. About a week before you begin this lesson, ask students to bring to class a variety of plastic containers. Emphasize that these plastic containers should be rinsed out and should not have contained any hazardous substances. From each type of plastic, plastic container codes 1, 2, 3, and 6 (the code is usually embossed on the bottom of the container), cut a piece approximately two inches square and label with the plastic container code number, using a permanent marker. Make a set of these for each group of three or four students.

**Note:** The terms “plastic container code”, “resin code”, “plastic’s resin number”, “code number”, and “plastic code number” are used interchangeably to describe the number embossed on the bottom of plastic containers.

- 3. Find out what plastics, if any, are recycled in your community.
- 4. Make a copy of “Test Your Plastic Polymers” (page 391) and “Plastics Coding System” (page 393) for each group of three or four students; and “Plastics at Home” (page 396) and “Plan for Inventing a New Use for a Plastic Object” (page 395) for each student.

## MATERIALS

### *For “Pre-Activity Questions”*

- Plastic sandwich bag
- Sharpened pencil
- Sink or bucket

### *For “Part I, Analyzing the Properties of Plastics”*

- A piece of 2-inch-square plastic from each of the following plastic containers, for each group of students:
- Polyethylene terephthalate (PETE) (plastic container code #1 from 2-liter soft drink bottles)
- High density polyethylene (HDPE) (plastic container code #2 from gallon jugs for milk or water)
- Polyvinyl chloride (PVC) (plastic container code #3 from glass cleaner bottles)
- Polystyrene (PS) (plastic container code #6 from foamed plastic plates, coffee cups, egg containers)

- Several plastic dish pans or buckets for the float test
- A copy of “Test Your Plastic Polymers” and “Plastics Coding System” for each group of three or four students

### *For “Part II, Inventing New Use for a Plastic Item”*

- A plastic item for each student
- A copy of “Plan for Inventing a New Use for a Plastic Object” for each student
- Art supplies

### *For “Part III, Testing to Determine Whether Plastics Biodegrade or Break Down”*

- A piece of 2-inch-square plastic from each plastic resin used in this lesson
- A piece of 2-inch-square paper from four different types of paper (e.g., cardboard, copy paper, construction paper, and paper towel)
- Two nylon stockings or mesh bags (e.g., onion bags)
- Outdoor planter, garden area, or other area in which the bags can be buried; or a large (12- to 16-inch) flower pot

### *For “Application”*

- A copy of “Plastics at Home” for each student

## PRE-ACTIVITY QUESTIONS

- A.** Write on the chalkboard or on a piece of butcher paper: “What We Know About Plastics.” Ask students to describe what they know about plastics, as you record their comments on the chalkboard or butcher paper. For example, can they tell you what are plastics and from what they are made?

### **What We Know About Plastics**

- B.** Write on the chalkboard or on a piece of butcher paper: “What We Would Like to

- |   |                                       |
|---|---------------------------------------|
| • Made from chemicals                               | • Strong                              |
| • Good for storage                                  | • Tough                               |
| • Can seal liquids                                  | • Durable                             |
| • Can be air tight—nonporous (air can’t go through) | • Melts                               |
|   | • There are different kinds           |
|   | • Birds get stuck in six-pack holders |

Submitted by Janet Cohen’s sixth-grade class, Gold Trail Elementary School, Gold Trail Union School District.

(Use school's letterhead.)

Dear Parent or Guardian,

Please read the following information with your child:

We are studying the properties of different plastics. Please send with your child by \_\_\_\_\_  
\_\_\_\_\_ one item from each of the following categories of plastic:

\_\_\_ Polyethylene terephthalate (PETE) (plastic container code #1: 2-liter soft drink bottle)

\_\_\_ High density polyethylene (HDPE) (plastic container code #2: gallon jug for milk or water)

\_\_\_ Polyvinyl chloride (PVC) (plastic container code #3: glass cleaner bottle) (Please rinse the bottle.)

\_\_\_ Polystyrene (PS) (plastic container code #6: foamed plastic plate, coffee cup, egg container)

Please do not send any plastic containers that have held hazardous substances.

Thank you,

Know About Plastics." Record students' questions. Keep these questions until the end of this lesson. Encourage students to conduct research on any unanswered questions about plastics at the end of this lesson.

C. Conduct the following demonstration:

- Fill a plastic sandwich bag with water.
- Ask for a student volunteer who is brave enough to stand under the bag while you push a sharpened pencil through it.
- Hold the bag over the volunteer's head. Jokingly tell the class that this event has never before been viewed on national television. Slowly rotate the sharp pencil in through one side of the plastic bag and out the other side. No water should leak out. (Do not push the pencil through completely.)
- Ask students to hypothesize why the bag did not leak when the pencil was pushed through.
- Have the volunteer take the bag over to a sink or a bucket and pull the pencil out to demonstrate that a "trick" bag was not used.
- Explain that plastics are formed into long chains, called polymers, by linking together small single chemical units, called monomers. Therefore, polymers are chemical compounds consisting of

repeating monomers that form chains. As the pencil is pushed through the bag, it slips between these chains. Unbroken, the chains slide around the shape of the pencil, sealing in the water. A dull pencil, however, breaks the chains and causes the bag to leak. When the pencil is removed, the polymers may move somewhat towards their original shape, but not enough to close the large pencil hole.

## PROCEDURE

### Part I, Analyzing the Properties of Plastics

- A. Provide a set of equal-sized pieces from four different types of plastics (soda bottle, milk jug, glass cleaner bottle, polystyrene cup or plate) and a copy of the chart, "Test Your Plastic Polymers," for each group. Ask students to discuss in their groups what type of results they expect to observe from their investigations.
- B. Ask students to look at the number found inside a triangle on the bottom of each container. Tell them to record on their charts the plastic container code number on the four types of plastics.
- C. Have students investigate properties of plastics by conducting the following four tests on each of the four pieces of plastic:

Picture intentionally deleted.

A student in Nona Reimer's fifth-grade class at John Malcom Elementary School determines a container's type of plastic resin.

1. Texture test
2. Flex tests (to determine pliability)
3. Float test
4. Scratch test (Students can use their fingernails or a paper clip.)

- D. Distribute a copy of "Plastics Coding System" to each group. Ask students to complete their charts, "Test Your Plastic Polymers."
- E. Encourage groups to share their results. Discuss the properties of the different types of plastics (e.g., some are stiff, others are light and flexible). Discuss why a particular type of plastic might be chosen for each type of package.

The following are what students should discover from their tests:

1. Polyethylene terephthalate (PETE), plastic container code #1:
  - a. Smooth
  - b. Highly resilient
  - c. Sinks in water (specific gravity: 1.40)
  - d. Hard to scratch
2. High density polyethylene (HDPE), plastic container code #2:
  - a. Textured
  - b. Semirigid to flexible; does not crack when bent

- c. Floats in water (specific gravity: 0.95)
  - d. Hard to scratch
3. Polyvinyl chloride (PVC), plastic container code #3:
    - a. Smooth
    - b. Forms white line when bent
    - c. Sinks in water (specific gravity: 1.30)
    - d. Scratches easily
  4. Polystyrene (PS), plastic container code #6:
    - a. It is smooth.
    - b. Foamed PS is semirigid, but breaks easily.
    - c. Foamed PS floats (specific gravity: less than 1.00). Note: The specific gravity depends on the extent to which the resin is foamed; unfoamed PS sinks (specific gravity: 1.05).
    - d. Foamed PS scratches easily.

**Note:** Specific gravity is the ratio of the density of the plastic to the density of water, which is 1.0. Plastics with higher densities than water will sink. However, some plastics that are supposed to sink floated during field tests.

- F. Once students have charted the different properties of the four plastics, ask the following questions:
- Why are there many different kinds of plastic in use? (One answer, based on the chemistry of plastics, is that different resins are suited to different uses, depending on their strength, flexibility, and resistance to specific chemicals.)
  - Why do plastics have to be separated before they can be recycled? *Each plastic has a different set of properties and is used for specific purposes. If mixed and melted together, the plastics would not have the specific properties needed for the specific uses.*
  - Which plastics are recycled in our community? (You might need to tell students or ask them to find out.) Note that plastic containers marked with plastic code numbers 1 and 2 are commonly recycled. Other plastics, usually not used for beverage containers, can possibly be recycled but are often not accepted at most recycling centers. Many types of plastic are not being recycled because there are not enough companies that

Picture intentionally deleted.

Students from Janet Cohen's sixth-grade class at Gold Trail Elementary School conduct a float test on different pieces of plastic.

make products from recycled plastics due in part to the difficulty of separating different types of plastic resin.

- G. Explain to students that the recycling process for plastic containers includes: (1) sorting the containers by their resin types; (2) cutting the plastic into tiny pieces, called pellets; (3) melting the pellets; and (4) reshaping into new plastic objects.

## Part II, Inventing New Use for a Plastic Item

- A. Tell students that they will be developing a new use for a plastic item that was going to be thrown into a garbage can. They will need to make some adjustment to the way the plastic item looks at this time. Show the different plastic items brought by students. Select one or two items, brainstorm ideas with students for new uses for this plastic item, and list the ideas on the chalkboard.
- B. Develop a rubric to help students identify how they will be judged on this project. One way to do this is to complete part "C" of the rubric with minimum basic requirements. Let the students formulate, with your assistance, the "A," "B," and "D" parts of the rubric. Proofread the rubric together and carefully go over it to make certain every student understands every part of the criteria that make up the rubric.<sup>1</sup> An example of a rubric is provided at the end of this lesson (page 394).

- C. Allow students to select a plastic item from those brought in by students. One way to do this is to put all the plastic items in a box and have students select one with their eyes closed.
- Provide a copy of "Plan for Inventing a New Use for a Plastic Object" for each student. Students can use an idea from the list brainstormed by the class or come up with another idea. Have students complete their plans about what they are going to make, how they will make it, and what materials they will need to make it.
  - Review and approve each plan.
  - Provide additional materials for students to facilitate their inventions.
- D. Agree on a time when the projects (and reports, if included in the rubric) are due. Provide time throughout the week for students to complete their projects.

**Note:** It is recommended that you provide instructions for a related project for students to do if they finish early.

- E. Allow enough time (usually a day or two) for students to present their project and for the class to grade each project, using the established rubric as a guideline.

Picture intentionally deleted.

A group of students from Janet Cohen's sixth-grade class at Gold Trail Elementary School design a project using 2-liter plastic bottles.

<sup>1</sup>Jacqueline Faber and Melissa C. Williams, *PBL: Beginning Steps—It's a Process!* Paper presented at the Fifth Annual Conference on Project-Based Learning, March 10, 1997.

Picture intentionally deleted.

Two students from Janet Cohen's sixth-grade class at Gold Trail Elementary School present the project they made from a plastic box.

### Part III, Testing to Determine Whether Plastics Biodegrade or Break Down

- A. Place pieces from the four types of plastics in a nylon stocking or mesh bag. To have something to compare, also place two-inch pieces of four different types of paper (e.g., cardboard, copy paper, construction paper, paper towel) in another nylon stocking or mesh bag. Bury both stockings or mesh bags in an outdoor planter, garden area, or other area. Do not use sterilized potting soil, because it contains no microorganisms to decompose material. Keep the soil moist. Check the item buried in three months.

**Note:** The items can also be buried in a large flower pot and kept indoors.

**Note:** Samples from four types of plastic can also be nailed on pieces of wood and placed in the sunlight to see whether they break down in the presence of sunlight.

- B. Discuss the concept of "biodegradable" plastic bags. Mention that most "biodegradable" plastics are made by splicing molecules of cellulose in between the regular polymer chains. Certain organisms possess the enzymes necessary to break down the cellulose molecules. When conditions are right, they can digest the cellulose, splitting up the synthetic polymer chains in the process. As a result, the plastic bag breaks into little bits of nonbiodegradable plastic. Ask students what the problems might be with little pieces of plastic.

### Three Months Later

- C. After three months have students unbury and check their plastics and paper products. Discuss with students:
- What did we find out?
  - Why do plastics not biodegrade? One hypothesis is that since plastic polymers are synthetic and have existed on Earth for such a short time, few, if any, organisms have developed enzymes that can break down their long polymer chains. Ask students how a species might evolve or develop such a capability. How might this capability benefit the species that evolves it?
  - Should we bury these items for an additional amount of time?

### APPLICATION

- A. Ask students to look at the chart developed in "Pre-Activity Questions." What can we add about what we know about plastics? List students' responses on the chart. Are there any corrections needed to make the statements more accurate?
- B. Discuss ways that students can reuse the plastic containers. Generate a list and post it in the classroom. Students can illustrate each use and add new uses. Encourage students to bring plastics from home and think of ways to reuse them for classroom use.
- C. Ask students to write in their journals what they can do to generate less plastic waste.
- D. Ask students which of the plastic container code numbers they might select when deciding on what product to buy in a plastic container. *Numbers 1 (PETE) or 2 (HDPE.)* Ask them to explain their answers. *These plastics are the ones most often recycled.* Share with students that although we may place our plastic containers in a recycling bin, it does not mean that they will be recycled. Several types of plastic containers are not recycled, because products made from recycled materials are not always profitable.

**Homework Assignment:** Provide a copy of "Plastics at Home" for each student. Ask students to conduct an audit of kitchen cupboards



in their homes and to complete the chart, “Plastics at Home.” They should identify eight plastic containers, such as a milk jug, polystyrene plate, and soda bottle, and record the product and brand (including the size of product); plastic container code number; whether the plastic is recyclable in their community; and the way it will probably be disposed (landfill/recycling center). Then the students should list ways each plastic product can be reused. Finally, they will list some reusable and recyclable substitutes for three of the plastic products that were going to go to the landfill.

**Note:** Some plastic products, such as plastic utensils, or plastic bags might not have a code number.

- E. Have students share the results of their homework assignment. Review what plastics are recyclable in your community and what plastics will probably be placed in landfills.

## EXTENSIONS

- A. Students can conduct additional tests on plastic.
- To differentiate plastic container code #2 (HDPE) from #4 (LDPE) and #5 (PP), use isopropyl alcohol.  
Plastic #2 will sink while plastics #4 and #5 will float in isopropyl alcohol.
  - To differentiate between plastic container code #4 and code #5, use Mazola brand corn oil (which has the correct density to separate #4 and #5) to test for buoyancy. Plastic #4 sinks in the oil and plastic #5 floats on the oil.

**Safety Note:** When using isopropyl alcohol, students must wear gloves and protective eye gear.

- B. Ask students to think of some everyday items made of plastic and the qualities that they ought to possess. Sample items might include car bumpers, cutting boards, ice cube trays, and laptop computer cases. Have students guess what kinds of plastic these items might be made from and then verify—through testing, reading manufacturer’s specifications, or locating information in other sources—to learn what type of plastic they are actually made from. What happens to these items once they are no longer wanted? Ask students to report their findings.

- C. Look at the chart developed in “Pre-Activity Questions.” Ask students to select any topic to research listed under “What We Would Like to Know About Plastics.” Have students share their findings with the class.
- D. To test whether degradable plastic really degrades, do the following:
- Obtain examples of the following plastics: (1) photodegradable; (2) cornstarch, biodegradable; (3) nondegradable from a water or milk jug; and (4) nondegradable plastic wrap.
  - Cut four equal-sized pieces from each type of plastic.
  - Nail a sample of each type of plastic on four separate blocks of wood. Label each block of wood, “A,” “B,” “C,” and “D.”
  - Place “A” in an area that receives a lot of sunlight, but where it will not be disturbed.
  - Bury “B” in the ground or in a planter box.
  - Place “C” in water.
  - Allow the students to decide where to place block “D.”
  - Have students record any changes every week for the first month and every month after that for several months.

## RESOURCES

### Videos

*Kids Talkin’ Trash.* San Leandro, Calif.: Alameda County Waste Management Authority, 1995 (14 minutes). Distributed by the California Integrated Waste Management Board

Students learn how to make less garbage and protect the environment by practicing the four R’s: reduce, reuse, recycle, and rot.

*Reuse.* Protecting Our Environment series. Chatsworth, Calif.: Pied Piper / Aims Media, 1992 (13 minutes).

Shows how household items can be reused. Includes information how to reuse yard trimmings, containers, and appliances. Also available in Spanish. For grades four through six.

## Website

For information on plastics, visit the website for the Plastics Marketing Guide at: [www.ciwmb.ca.gov/Plastic/Markets/Default.htm](http://www.ciwmb.ca.gov/Plastic/Markets/Default.htm).

## Book

*The Plastic Waste Primer: A Handbook for Citizens.* Prepared by the League of Women Voters Education Fund. New York: Lyons & Burford, Publishers, 1993.

## Activity Guide

*Plastic Eliminators: Protecting California Shorelines* (Learning Activities for Youth Groups, Age 10–15). Santa Barbara: California Aquatic Science Education Consortium, nd.

Contains activities that describe for students how to deal with the problems of plastic debris that affect marine life, how to recycle plastics, and how to participate in the Adopt-a-Beach program sponsored by the California Coastal Commission.

To help consumers identify more easily the different types of plastic, the industry has developed a numbered coding system. These

TEST YOUR PLASTIC POLYMERS

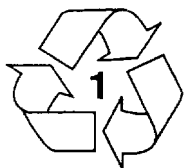
Plastic item	The plastic container code (e.g., 1, 2, 3, 6)	Type of plastic (e.g., PETE, HDPE, PVC, PS)	Float test: sink or float	Texture test: smooth or textured	Flex test (Does it bend?): yes or no	Scratch test: easy or hard
Soda bottle						
Milk, water, or juice jug						
Glass cleaner bottle						
Foamed plastic cup, egg carton, or plate						

# ANSWERS TO “TEST YOUR PLASTIC POLYMERS”

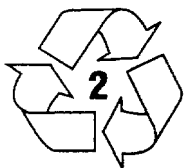
Plastic item	The plastic's container code (e.g., 1, 2, 3, 6)	Type of plastic (e.g., PETE, HDPE, PVC, PS)	Float test: sink or float	Texture test: smooth or textured	Flex test (Does it bend?): yes or no	Scratch test: easy or hard
Soda bottle	1	PETE	Sinks	Smooth	Yes	Hard
Milk, water, or juice jug	2	HDPE	Floats	Textured	Yes	Hard
Glass cleaner bottle	3	PVC	Sinks	Smooth	Yes, forms white line when bent	Easy
Foamed plastic cup, egg carton, or plate	6	PS (polystyrene that is in the form of foam)	Floats	Smooth	No (breaks easily)	Easy

## PLASTICS CODING SYSTEM

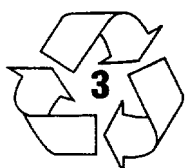
code numbers are embossed on the bottom of containers and other plastic items or printed on plastic bags. Number 1 and the unpigmented 2 types of plastics are most commonly recycled.



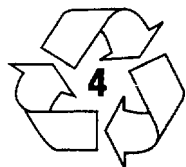
**PETE** (polyethylene terephthalate): Plastic is soft, generally clear. This plastic is used for food and beverage containers, such as soda bottles, cooking oil bottles, and peanut butter jars.



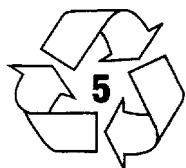
**HDPE** (high density polyethylene): Plastic is translucent or white or colored. This plastic is used for milk, water, and juice bottles, bleach and detergent bottles, margarine tubs, and some grocery bags.



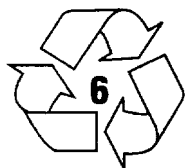
**PVC VINYL** (polyvinyl chloride): Color of plastic varies. This plastic is used in glass cleaner bottles, some cooking oil containers, and some detergent powders. (PVC has properties of good chemical resistance, which is important for holding household detergents and other harsh materials.)



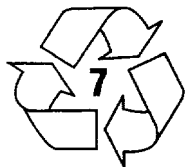
**LDPE** (low-density polyethylene): Color varies. This plastic is used in food packaging, shrink wrap, carry-out bags, and heavy-duty bags.



**PP** (polypropylene): Color of plastic varies. This plastic is used in butter and margarine tubs, yogurt containers, screw-on caps, and drinking straws.



**PS** (polystyrene): Plastic may be clear, hard, or in foamed form. This plastic is used in cutlery and plates, foamed plastic coffee cups, egg cartons, meat trays, and yogurt cups.



**OTHER**: Color varies. Containers made of more than one resin type. This plastic is used in squeezable syrup and condiment bottles and in some microwave food trays.

Adapted from National Polystyrene Recycling Company, *How-to-Recycle Polystyrene*, 25 Tri-State International, Lincolnshire, IL 60069; (707) 945-2139.

# RUBRIC FOR ASSESSING WORK ON INVENTION OF A NEW USE FOR A PLASTIC OBJECT

A	B	C	D
1. Complete a plan for inventing a new use for a plastic object.	1. Complete a plan for inventing a new use for a plastic object.	1. Complete a plan for inventing a new use for a plastic object.	1. Missing any of the parts (1–3) in the plan.
2. Make your plastic invention.	2. Make your plastic invention.	2. Make your plastic invention.	2. Worked a little bit on the plastic invention
3. Stay “on task.” If working with partners, each member has more than one job.	3. Stay “on task.” If working with partners, each member has more than one job.	3. Stay “on task.” If working with partners, each member has at least one job.	3. Did not stay on task.
4. Invention is complete, and careful work with details is evident. The invention works.	4. Invention is complete, and careful work with details is evident.	4. Invention is complete.	4. Invention is not complete.
5. Report on the invention is complete and neatly done.	5. Report on the invention is complete and neatly done.	5. Report on the invention is complete.	5. Report on the invention is incomplete.
6. Lots of time, creativity, and work have been put into your invention.	6. Lots of time and work have been put into your invention.	6. Some time and work have been put into your invention.	6. Not much time or work has been put into your invention.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## PLAN FOR INVENTING A NEW USE FOR A PLASTIC OBJECT

1. What I want to do for my invention: \_\_\_\_\_

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2. How I will do it: \_\_\_\_\_

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3. Materials I will need: \_\_\_\_\_

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

**PLASTICS AT HOME**

Product and size of product in a plastic container	Plastic container code number	Recyclable in your community? Yes/No	Disposal method for this plastic (landfill or recycling center)	How can this plastic be reused?
<i>Example: gallon of milk</i>	2	Yes	Recycling center	<i>For a storage container; planter; piggy bank.</i>
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

List some reusable and recyclable substitutes for three of the plastic containers listed above that are not reusable or recyclable and will probably be sent to a landfill.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

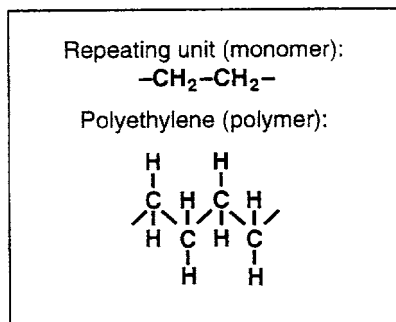


# BACKGROUND INFORMATION FOR THE TEACHER

The very first plastics were made from corn-starch, but most plastics today are made from natural gas and crude oil. Plastics are made by linking together small single chemical units, called monomers, in repetition to build one large chain-like molecule, called a polymer.

Some polymers are natural substances that come from vegetables and animal sources. They include the horns of animals, tortoise shell from the hawksbill turtle, rosin from the sap of pine trees, and asphalt from decayed plants and animals.<sup>2</sup>

The plastic polymers are made from hydrogen and carbon elements, sometimes in combination with small amounts of oxygen, nitrogen, and other organic and inorganic compounds. For example, polypropylene and polystyrene are polymers that contain only carbon and hydrogen. Nylon also contains nitrogen; and polyvinyl chloride contains chlorine. When re-arranged chemically, a solid resin is produced. The resins are used to make hundreds of different plastics, all of which fall into two basic categories: thermoplastics and thermosets.



Thermoplastics are formed by combining the same polymer molecules together, like molecules of water. Thermoplastics liquefy at high temperatures and solidify when cool. This property makes it easy to melt the plastic and reform it into new objects. Thermoplastics are used primarily for packaging. Specific types of thermoplastic are polyethylene, polystyrene, polyvinyl chloride, and polypropylene. (For descriptions of these plastics, see "Plastics Coding System" in this lesson.)

<sup>2</sup>From *Hands on Plastics: A Scientific Investigation Kit*. Columbus, Ohio: American Plastics Council Incorporated, 1997, p. 2.

Thermosets are formed by combining different polymer molecules. Once linked together in a chemical reaction, they are virtually impossible to separate. They cannot be melted and re-formed into new shapes, and this makes them difficult to recycle. Thermosets are widely used in furniture, toys, tableware, computer casings, and other permanent uses requiring a hard plastic. Polyester, epoxies, and melamine are all thermoset plastics.

The various types of rigid plastic containers are coded with numbers to indicate the types of resin from which they were made. These plastic container code numbers are embossed in the bottoms of each container. Plastics with codes 1 and 2 are commonly recycled because they are present in large quantities and have more markets available. At this time only PETE bottles and unpigmented (clear) HDPE bottles are generally recyclable.

According to California Integrated Waste Management Board's estimates, only 3.5 percent of all plastics were diverted from landfills in 1995. Unfortunately, many types of plastic are not being recycled because there are not enough companies that make products from recycled plastic, due in part to the difficulty of separating different types of plastic resin.

Although plastics currently comprise about 6.7 percent by weight of California's solid waste stream, their volume is three times greater than their weight, which means more space is used in the landfill.<sup>3</sup> Plastics are the fastest growing segment of the waste stream.

The popularity of plastics has increased for several reasons. Plastics are durable; lightweight; waterproof; very resistant to chemicals; easily moldable; require less secondary, protective packaging; add to consumer convenience; and are relatively inexpensive to produce. Their chemical properties can be manipulated to achieve just the right combination of properties for any application. The largest markets for plastics in 1994 were packaging and construction industries.<sup>4</sup> However, plastics are made

<sup>3</sup>Written communication from Edgar Rojas, Integrated Waste Management Specialist, Secondary Materials Section, California Integrated Waste Management Board, October 20, 1998.

from a nonrenewable resource—fossil fuels. Although some plastics are relatively inexpensive to manufacture, the crude oil and natural gas from which they are made come from limited supplies, the increasingly complicated extraction of which often has serious, negative environmental and/or political impacts.

The same characteristics which make plastic an attractive packaging material, also make it a special problem in the waste stream. Though lightweight, plastic is bulky and difficult to compact for shipping or for burial in landfills. Plastic will not biodegrade. Photodegradable plastics may break down into smaller pieces when exposed to enough sunlight but will never really disappear.

The durability of plastics not only makes these synthetic materials very useful but also makes them very difficult for natural systems to recycle. All life forms are dependent on the ability of bacteria, fungi, and other microorganisms to break down natural polymers, such as wood, cotton, and dead organisms, so that the resulting monomers can be used as the building blocks for other life forms. This is where plastic polymers become a problem, because they do not readily decompose under natural conditions. Their chemicals are locked out of the life cycles, effectively removing a natural resource from the environment.

Compounds in “photodegradable” plastics have a chemical bonding that causes these plastics to disintegrate with prolonged exposure to sunlight. These plastics are being used for beverage “six-pack” rings, shopping bags, and in some commercial agricultural applications (e.g., drying trays for raisins). They do break down into smaller pieces of plastic but do not actually decompose.

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<sup>4</sup>From *Hands on Plastics: A Scientific Investigation Kit*. Columbus, Ohio: American Plastics Council Incorporated, 1997, p. 3.

Recently the “biodegradable” label has been used for a number of plastics (particularly shopping bags) that use cornstarch or other organic substances as bonding agents in or in combination with crude oil plastics. Like photodegradable plastics, these plastics do break down as their organic matter decomposes, but they degrade into smaller pieces of plastic which do not biodegrade. Biodegradable plastics are generally an impractical solution for disposal of plastic waste. They are typically unable to photodegrade or biodegrade in modern landfills because of the absence of ultraviolet radiation, oxygen, and moisture. Many serious questions also remain about the toxicity of the decomposition by-products associated with biodegradable plastics.

The whole idea of “biodegradable” plastics is not just misleading; it could also draw attention away from more promising answers to the waste problem. These include reducing the amount of plastic we use and developing new methods to recycle the plastic we no longer need.<sup>5</sup>

True biodegradable plastics, plastics that disintegrate into organic substances as the result of natural processes, are largely experimental and have not come into wide use because of their relative high cost.

**Note:** Additional information about plastics is included on the website listed in the “Resources” section in this lesson; in the “Background Information for the Teacher” in the K–3 Module, Unit 2, Lesson 1; and in “Appendix C–VIII, Plastics.”

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<sup>5</sup>Evan Hadingham and Janet Hadingham. *Garbage! Where It Comes From, Where It Goes*. New York: Simon and Schuster, Inc., 1990, p. 22.

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.

### *For “Pre-Activity Questions”*

- Several pieces of assorted trash

### **For younger students**

See “Procedure, Part I” and decide on “Option 1” or “Option 2.” If you select “Option 1,” only one station needs to be set up each day, and only one set of trash items will be needed. If you select “Option 2,” set up all five stations.

- 2. At each station leave six trash items listed in the “Materials” section and the corresponding “Activity Cards for the Stations” (page 406). Provide the tools needed for each station:
  - **Size Station:** a ruler
  - **Weigh Station:** a weight scale or balance beam
  - **Magnetism Station:** magnets
  - **Sinkers and Floaters Station:** a container of water
  - **Shredding Station:** scissors  
(This station may need an adult supervisor.)
- 3. Make copies of the “Sorting Sheet” for each pair of students (pages 407 and 408). Consider laminating these sheets and having students use pens with wipeable ink to complete the chart. Then these sheets can be reused by other classes.
- 4. Make a transparency of “Properties of Recyclable Items” (page 409) and the “Sorting Sheet.”

### **For older students**

- Duplicate “Properties of Recyclable Items.”

## MATERIALS

- Optional: The video, “The Rotten Truth”

### *For “Part I, Using Separation Techniques to Separate Recyclables”*

### **For younger students**

- Ruler
- Weight scale (or balance beams)
- Scissors
- A magnet (preferably a bar magnet attached to a flat piece of wood)

- A small fan with two speeds or a hair dryer with two speeds (If not available, a heavy piece of cardboard can be used as a fan.)
- An aquarium tank or other large container for water
- One set of the following six items if doing “Option 1” and five sets of the following six items if doing “Option 2” (Substitutes for any of the objects can be used if they are easier to obtain.)
  - Aluminum can
  - Soup can
  - Piece of paper (8½ by 11 inches)
  - Plastic 2-liter soda bottle
  - Piece of polystyrene (Styrofoam)
  - Orange or banana peel
- A copy of “Activity Cards for the Stations,” cut apart
- A copy of the “Sorting Sheet” for each pair of students
- A transparency of “Properties of Recyclable Items”

### **For older students**

- Weight scale (or balance beams)
- A transparency of “Properties of Recyclable Items”

### **For each group of older students**

- A set of the following ten trash items: aluminum can, tin can, plastic 2-liter bottle, polystyrene (Styrofoam) container, an orange or banana peel, several used or unused staples, piece of paper (8½ by 11 inches), pieces of cardboard, piece of wood, and a steel bottle cap (Have extra pieces of paper or cardboard on hand.)
- Ruler
- Scissors
- A magnet (preferably a bar magnet attached to a flat piece of wood)
- A small fan with two speeds or a hair dryer with two speeds (If not available, a heavy piece of cardboard can be used as a fan.)
- A plastic pan or other large container for water
- A copy of “Properties of Recyclable Items”

**Note:** To reduce the number of materials needed for this lesson, one station can be set up for each test. Groups can rotate from one station to another to test their trash items.

### For “Part II, Separating the Recyclables Manually”

- Long sheet of butcher paper (approximately 10 feet to 15 feet long)
- Several cardboard boxes (Label each box by a specific recyclable material [e.g., aluminum, containers from #1 plastic, paper].)
- Waste items from “Part I” and clean waste from the class garbage can to represent recyclable and nonrecyclable materials

### PRE-ACTIVITY QUESTIONS

- A. Begin with the following discussion:
- “Has anyone ever seen the inside of a materials recovery facility, also called a MRF (pronounced “Merf”)? A materials recovery facility is usually a huge building where all the recyclables from local communities are taken and separated by machines and by people. Then the recyclables are trucked to be recycled. We will be setting up a small materials recovery facility in our classroom. In order to learn how a materials recovery facility works, you need to learn about the properties of recyclables.”
- B. Have students sit in a circle, and place several recyclable items in the middle. Ask the following questions:
- How could we separate these items, based on their properties? *By using magnets, by looking at them.*
  - What are the differences among the dif-

ferent materials? *Some are plastic; some, aluminum.*

- What are some properties of these items that will allow us to separate them? *Heavy, light, magnetic or not, sinkers, floaters, shredable (easy to cut or not).*

- C. Make a class list of different properties of the recyclable items.

### PROCEDURE

#### Part I, Using Separation Techniques to Separate Recyclables

**Note:** If the video is available, show Part 2, “Where Does It Go?” from *The Rotten Truth*.

#### For younger students

- A. Tell students that in this activity they will learn more about the properties of recyclable items. They will also simulate what happens at a materials recovery facility.

Students will explore one property at a time.

- B. If you are setting up one station for each of five days, do “Option 1.” If you are setting up rotation stations (if this activity will be done in one day), do “Option 2.” As a class, go over the sorting sheet and have students predict the results. Write these on the transparency, “Sorting Sheet.”



Davis Street SMaRT (Station for Material Recycling and Transfer), San Leandro, California.

### Option 1

If only one station per day is set up:

- As a class, go over the station's directions and ask students to predict the results as you write these in the proper station on the "Sorting Sheet" transparency.
- Set up one station by providing an activity card with directions and the tool described in the activity card.
- Provide a set of six objects and allow one pair of students to visit the center, while the rest of the class works on another assignment.
- Tell students that they will be testing six items at the station.
- Provide a "Sorting Sheet" for each pair of students and ask them to complete the section that corresponds to the center (e.g., size station).
- As a class, complete the appropriate section on the transparency, "Properties of Recyclable Items."

### Option 2

If the rotation method is used:

- At each station, leave six items listed in the "Materials" section, an activity card with directions, and the tool (e.g., ruler) described in the activity card.

- As a class, go over each station's directions and ask students to predict the results as you write these in the proper station on the "Sorting Sheet" transparency.
- Separate the class into five groups.
- Tell students that they will be testing six items at every station for specific properties. Each group will rotate from one station to another.
- Provide a "Sorting Sheet" for each pair of students.
- Model possible explorations at each station before starting group rotations.
- Give each group a reasonable time (about five to ten minutes) to explore each station; then rotate each group to the next station.
- Allow the last group at each station to share its findings with the class.
- Have students compare their findings to their predictions.
- Complete numbers 1 through 6 on the chart, "Properties of Recyclable Items," as a class.

The stations are:

- **Size Station:** Students sort six objects from largest to smallest. Have rulers available.

Picture intentionally deleted.

A group of students from Janet Cohen's sixth-grade class at Gold Trail Elementary School look at the waste items they received before testing the properties of each item.

- **Weigh Station:** Students sort six materials from heaviest to lightest, using a weight scale or balance beam.
  - **Magnetism Station:** Students explore which six items are magnetic.
  - **Sinkers and Floaters Station:** Students test six items to see whether each sinks or floats. Have a container of water available.
  - **Shredding Station:** Students try to cut six different items. Have scissors available. (This station may need an adult supervisor.)
- C. Lead students in a debriefing of what they found out at each station. Help students make a graph of the results.
- D. Explain to students that they are simulating some machines that separate materials at a materials recovery facility. In “Part II” they will simulate how workers at some materials recovery facilities separate materials.

#### For older students

Students will work in groups to test the properties of ten waste items.

- A. Tell students that in this activity they will learn more about the properties of recyclable items. They will also simulate what happens at a materials recovery facility.
- B. Discuss the concept of properties of matter; e.g., size, shape, weight, magnetism.
- Discuss the importance of sorting waste according to the type of material from which the waste was made before it can be recycled.
  - Show students the pieces of paper and staples.
  - Explain how these often end up together at paper recycling plants and can be separated, based on the physical property of magnetism in staples.
- C. Divide the class into small groups. Give each group a set of ten waste items listed in the “Materials” section. Discuss some physical properties of these items.
- D. As a class, go over each station’s directions and ask students to predict the results as you write these in the proper station on the “Sorting Sheet” transparency. Another way to do this is to provide the “Sorting Sheet” to each group of students and ask them to
- write their predictions for each station in their journals.
- E. Distribute a copy of the handout, “Properties of Recyclable Items,” to each group of students, and have the group complete it. Students will need to test the items in various ways in order to make choices on the handout. For this, provide to each group rulers, a container of water, a magnet, and scissors.
- Note:** Each test could also be set up as a station. Groups can rotate from one station to another to test their trash items.
- F. After the charts have been completed, discuss the answers and have students compare their findings to their predictions.
- G. Tell students that they will design a mechanized materials recovery facility. In Part II of this lesson, they will experience a manual way to separate waste. Display on a large table a magnet, a small fan or hair dryer, a container of water, and scissors. Instruct students to use the information on the handout and the equipment to develop a process for separating all ten items individually. Tell students:
- Do this by designing separation techniques in a series of stages. You must begin with all ten items in one pile bunched up close together on the table.
  - Since this is a mechanized materials recovery facility, you can pick up items only with a separation instrument or technique. You cannot use your fingers to pick up items.
  - The goal of each group is to separate the items most efficiently; i.e., in the fewest steps or with the most success.
- H. Demonstrate this process (as described below) for students to give them ideas, but encourage students to participate in the thinking process of this separation.
- Ask students to look at their information sheets and predict which items should float and which will not.
  - Put all ten items in the water.
  - Put those items that floated on the table in a separate bunch from those which did not float. This represents the first stage or step to be counted in the process.

Picture intentionally deleted.

Students from Nona Reimer's fifth-grade class at John Malcom Elementary School test materials to see whether they sink or float.

- Explain this process. The next step(s) must involve sorting items from each of the two piles. Eventually, you want to separate each item individually. The individual separation of one item from the rest could happen in a first step or on the sixth step, depending on the material and the design of the separation techniques.
- Do another demonstration.
  - Use scissors to make a pile of shredded plastic (from the bottle) and of shredded paper.
  - The shredding process represents only one stage, although two types of materials have been shredded.
  - Use a hair drier or fan. A piece of heavy cardboard can be used as a fan. If a fan is used, set the fan on the table in front of the pieces of paper and plastic.
  - Put the cardboard box at the end of the table. Turn the fan on at a distance from the pieces and at a speed which

will blow only paper into the box (or perhaps only the plastic if the paper is wet from having been in the water).

- Now you have separated these two items in two steps, including the shredding process.
  - You have eight more items to separate.
- I. Explain that you have deduced this step, based on information about the weight of the materials listed on the handout. One important separating technique would be one that separates the items into three piles instead of two.
- J. Direct pairs or groups of students to look carefully at their information sheets and to design stages in a process to separate all of the materials.
- K. Have each pair or group of students conduct the separation steps and then present its findings to the class.
- L. The judgment about which is the "most efficient" could be put to the test by classmates for their observation and measurement. Which group had the fewest steps. Why might fewer steps be more desirable? *Yes. Why? It takes fewer machines, less time, and less energy and, therefore, would cost less.*

## Part II, Separating the Recyclables Manually

In this activity students will simulate how workers separate materials at some materials recovery facilities.

- A. Have a group of students sit along both sides of a long sheet of butcher paper on the floor. This butcher paper represents a conveyor belt.
- Place several cardboard boxes next to students and label each box according to a specific recyclable material (e.g., aluminum, plastic #1 bottles, paper).
  - Spread recyclable and nonrecyclable waste on the paper.
- B. Assign certain students to pick out specific items, such as aluminum, plastic bottles, etc.
- C. When students are ready, slowly pull the paper as students pick off specific items. The goal is to pick off all recyclables, so that

only nonrecyclable materials that will be going to the landfill remain.

- D. Have students come up with ideas on how the piece of butcher paper used in this activity can be reused. *Use it to cover a bulletin board, cut to the size to make posters or murals for future lessons, use it for art projects.* You might also consider rolling it up and storing it until the class comes up with an idea that all students like.

## DISCUSSION/QUESTIONS

- A. Discuss which method of separation is most efficient: curbside separation, separation by machines at a materials recovery facility, manual separation at a materials recovery facility. Which would be most energy-efficient? Explain why.
- B. Discuss which items are recycled in the community and which are not. Of the items recycled in the community, which could be separated by the methods we used in this lesson?

## APPLICATION

- A. Have students explain how the techniques described below can be used to separate recyclable materials and which materials would most likely be separated with this technique:
  1. Using air
  2. Using magnets
  3. Using water
  4. Using a size-sorting device
- B. Encourage students to come up with one more way that recyclables could be separated from each other.

## FIELD TRIP

If you have a materials recovery facility in your community, schedule a field trip for students to observe this facility. If a field trip is not possible, consider showing students a video clip on a materials recovery facility (see “Resources”).

## EXTENSIONS

- A. Judge the designs for separating recyclable materials made in this lesson, based on

energy efficiency. Students can create a scale of energy required to use the various pieces of equipment. The winner is the team using the least amount of energy.

- B. Have students design a size sorter (e.g., a cardboard box at least one foot by one foot with two-inch square holes cut in the bottom and another cardboard box with flaps removed but without holes). Have them test these sorters.

## RESOURCES

### Videos

*Recycling: Waste into Wealth.* Oley, Pa.: Bullfrog Films, 1984 (29 minutes). Grades five through adult.

This video describes recycling techniques, including curbside pick-up services, drop-off recycling centers, materials recovery facilities, and processing into new products.

*The Rotten Truth.* 3-2-1 Contact Extra series, produced by Children’s Television Workshop, 1990 (30 minutes). Pleasantville, N.Y.: Sunburst Communications, distributor.

Stephanie visits a landfill and explains the problems created by the solid waste we generate. Discusses some options of waste management.

### Books

Gibbons, Gail. *Recycle! A Handbook for Kids.* New York: Little, Brown & Company, 1992.

Colored illustrations and simple text describe how and what to recycle. Also explains how paper, glass, aluminum, and plastic are recycled.

Jacobs, Francine. *Follow That Trash! All About Recycling.* New York: Grosset and Dunlap, 1996.

Although written for grades one through three, this book contains illustrations and descriptions on how waste is separated at a materials recovery facility.

### Websites

See “Appendix F–V, Recycling websites.”



## ACTIVITY CARDS FOR THE STATIONS

**1. Size Station:** Use a ruler to measure and then sort the five objects from largest to smallest. Write down the order of the objects from largest to smallest.

**2. Weigh Station:** Use a weight scale or balance beam to weigh each object. Then write down the name and weight of each object.

**3. Magnetism Station:** Use a magnet to determine which items are magnetic and which are not magnetic. Record what you have found.

**4. Sinkers and Floaters Station:** Test each item to see whether it floats or sinks in the container of water. Record your findings.

**5. Shredding Station:** Use scissors to cut the different items. Record your results.

Names: \_\_\_\_\_ Date: \_\_\_\_\_

## SORTING SHEET

### 1. Size Station:

	Length and width of item
• The largest item was _____	
• The second largest item was _____	
• The third largest item was _____	
• The fourth largest item was _____	
• The fifth largest item was _____	
• The smallest item was _____	

**2. Weigh Station:** Weigh each object and write down the name and weight of each of the six objects.

Object		Weight
1.		
2.		
3.		
4.		
5.		
6.		

Which object is heaviest? \_\_\_\_\_

Which object is lightest? \_\_\_\_\_

### **3. Magnetism Station:**

These items are magnetic:

\_\_\_\_\_

These items are not magnetic:

\_\_\_\_\_

### **4. Sinkers and Floaters Station:**

These items sink:

\_\_\_\_\_

These items float:

\_\_\_\_\_

### **5. Shredding Station:**

These items cut easily:

\_\_\_\_\_

These items are difficult to cut:

\_\_\_\_\_

# PROPERTIES OF RECYCLABLE ITEMS

Waste item	Properties				
	Size	Weight	Magnetic yes or no	Sinks or floats	Shredable yes or no
1. Aluminum can					
2. Tin can					
3. Piece of paper					
4. Plastic 2-liter soda bottle					
5. Polystyrene (e.g., foamed plastic cup)					
6. Orange or banana peel					
7.					
8.					
9.					
10.					

# LESSON 8: Separation Mania

## LESSON'S CONCEPT

Waste can be sorted by physical properties, and some waste materials can be recycled.

### PURPOSE

Students identify ways waste items are sorted for recycling at a materials recovery facility.

### OVERVIEW

**Note:** In this lesson “older students” refers to students in fifth and sixth grades; “younger students” refers to students in fourth grade.

In this lesson younger students will:

- Identify specific properties of recyclable items by determining which items sink or float, are magnetic, can be moved by wind, or can be easily cut or shredded.
- Compare different characteristics of recyclable materials.
- Determine ways to sort recyclable materials.

In this lesson older students will:

- Use several mechanisms to separate ten different recyclable waste items and record the results on a data sheet.
- Identify specific properties of recyclable items by determining which items sink or float, are magnetic, can be moved by wind, or can be easily cut or shredded.
- Recognize that the techniques they used to separate certain recyclable items are similar to the ways used to separate recyclables at a materials recovery facility.
- Work in groups to develop an efficient design for the separation process, based on the data they have gathered on their data sheets.

All students participate in manually separating recyclables on a simulated conveyor belt to show how a materials recovery facility works.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS

- Students collect data about properties of recyclable materials.

- Students “classify objects . . . based on appropriate criteria.” (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 6a*)
- Students “record data using appropriate graphical representation (including charts, graphs, and labeled diagrams), and make inferences based on those data.” (*Science Content Standards, Grades K–12; Grade 5; Investigation and Experimentation, Standard 6g*)
- “Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings.” (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 18*)
- Students work in groups to develop methods to separate recyclables.
  - Students “measure and estimate weight, length, or volume of objects.” (*Science Content Standards, Grades K–12; Grade 4; Investigation and Experimentation, Standard 6b*)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, ordering, classifying, relating

### TIME

30–60 minutes to prepare for the lesson; 90 minutes to implement the lesson (If working with younger students and setting up one station per day, it will take five days at 30–45 minutes per day to complete Part I.)

### VOCABULARY

materials recovery facility, properties

# BACKGROUND INFORMATION FOR THE TEACHER

Many communities have curbside recycling. In some communities the recyclable materials are separated at home (at the source) and placed in separate containers (e.g., one container for glass, one for aluminum) or prepared in a specific way (e.g., newspapers are bundled and tied). These recyclables are set out on the curb during trash pickup days. In other communities all recyclables are placed together in one container and all other garbage in another container (i.e., garbage can) for curbside pickup. In some communities people do not sort their garbage at home. They place all types of waste in one can.

Recyclables that have not been separated at the source are often separated from each other (and sometimes from other nonrecyclable waste) at a materials recovery facility (MRF) (pronounced “Merf”), where they are sorted by machines and by people. Each MRF is designed differently. Some use mechanical means to separate recyclables, such as magnets to separate iron and steel from nonferrous metals. Other MRFs have people separating the waste. Still other facilities use both mechanical and manual means to separate the waste. The recyclable materials are usually cleaned, and those materials that can be compressed (e.g., paper and plastics) are baled before being transported to reprocessors. Materials that cannot be compressed, such as glass and

steel, are loaded into trucks for transporting to processing plants.

“Hi-tech” separation facilities are very expensive and prone to mechanical failure. But they include machines that move recyclables through tunnels that use air to separate paper and other light materials. They might also have machines that separate heavy substances, such as glass, by weight. Many MRFs also have machines that shred certain recyclables.

“Low-tech” facilities can also be efficient and provide jobs for people. At these facilities people sort through mixed recyclables by hand, pulling out paper, ferrous metals, aluminum, plastic, glass, and other recyclables. Many MRFs use both people and machines. Additional information on MRFs is provided in “Appendix B–III, Recycling.”

Understanding the physical properties of materials will help students to appreciate the ease or difficulty with which each can be reused, recycled, or disposed. This activity addresses the ways that large amounts of materials can be separated from each other for recycling or other alternatives.

# LESSON 9: Buying Recycled Products

## LESSON'S CONCEPT

Purchasing and using materials made from recycled products instead of nonrecycled products conserves natural resources.

### PURPOSE

Students learn about items made from recycled materials.

### OVERVIEW

In this lesson students will:

- Discuss what types of materials can be made from recycled products.
- Compare the properties of paper towels made from recycled fibers to those made from nonrecycled fibers and design a chart to summarize their finding.
- Identify five items in their homes that are made from recycled materials.
- Conduct an informal survey to find out why people do not buy more products made from recycled materials.
- Work in groups to investigate the differences between white paper made from recycled and nonrecycled fibers and the differences between plastics made from recycled materials and nonrecycled materials.
- Design or invent an item that can be made from recycled materials.
- Present arguments on why recycled paper and other products made from recycled materials should be bought and used.
- Describe how to “close the loop” in the use of paper.
- Design an advertisement for a product made from recycled materials.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students participate in a discussion about, and work in groups to conduct research on, the differences in items made from recycled and nonrecycled materials.

- “Students listen critically and respond appropriately to oral communication.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 20)
- Students observe and compare properties of paper towels made from recycled fibers to paper towels made from nonrecycled fibers.
  - Students “measure and estimate weight, length, or volume of objects.” (*Science Content Standards, Grades K–12; Grade 4; Investigation and Experimentation*, Standard 6b)
  - “Many forms of matter are identifiable by their color, texture, or shape; by their hardness or flexibility; by their taste and odor; by the sound or light that they emit and that we can perceive.” (*Science Framework*, page 41)
- Students present arguments about whether recycled paper and other products made from recycled materials should be bought and used.
  - “Students listen critically and respond appropriately to oral communication. They speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 26)
- Students design an advertisement for a product made from recycled material.
  - Students “choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten*

## SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, relating, inferring, applying

## TIME

60 minutes to prepare for the lesson; 60–90 minutes to implement Part I; two or three days at 45–60 minutes per day for Part II; about 60 minutes for the rest of the lesson

lesson.

- \_\_\_ 2. Obtain school supply catalogs (which can be borrowed from your school's or district's office) for some recycled products.
- \_\_\_ 3. Obtain other catalogs that contain descriptions of products made from recycled products (a list is on page 420).
- \_\_\_ 4. Make a transparency of "Closing the Loop with Recycled Paper Products" (page 418).
- \_\_\_ 5. Make a copy and cut apart "Instructions for Group Investigations Concerning Recycled Products" (page 417).

## MATERIALS

### *For "Part I, Comparing the Properties of Paper Towels"*

- \_\_\_ Two types of paper towels: one made with recycled paper and one without; make sure that they look similar in size and weight and contain the same amount of ply (one or two). Keep the sales receipt to provide students with the cost information for each roll of paper towels.
- \_\_\_ Duct tape
- \_\_\_ Scissors
- \_\_\_ Balance or other weight scale
- \_\_\_ Washers (about 100, same size to use as weights)
- \_\_\_ Four containers of water in which to dip the paper towels
- \_\_\_ Four containers in which the water from wet paper towels can be squeezed
- \_\_\_ Four measuring cups or graduated cylinders
- \_\_\_ A symbol and writing from a package (e.g., cereal box) that indicates that the box is made from recycled material

## VOCABULARY

closing the loop, pre-consumer, post-consumer, recycled materials

## PREPARATION

- \_\_\_ 1. Read the "Background Information for the Teacher" at the end of this

- \_\_\_ A symbol from a package that indicates that the box can be recycled

### *For "Part II, Group Investigations About Products Made from Recycled Materials"*

- \_\_\_ School supply catalogs
- \_\_\_ Catalogs that contain description of products made from recycled products
- \_\_\_ A ream of recycled paper and one of nonrecycled paper
- \_\_\_ Cut-apart copies of "Instructions for Group Investigations Concerning Recycled Products" (Number of copies will depend on the number of groups.)

### *For "Application"*

- \_\_\_ The transparency of "Closing the Loop with Recycled Paper Products"

**Note:** Students might need additional supplies to help them complete their investigations.

## PRE-ACTIVITY QUESTIONS

- A. Ask students to describe the steps of bringing a piece of paper from a tree to their classroom. *For example: tree to lumber mill to paper mill to store or warehouse to school to class.* If possible illustrate these steps. Discuss with students:
  - After the paper is used by a student, what could be the next step? *The paper is thrown away and sent to a landfill; the paper is used on both sides and placed in the paper recycling box.*
  - If the paper is recycled, what will happen to it? *The paper will be picked up by a recycling company and taken to a storage facility and then to a paper manufacturing plant where it will be made into new paper.*
  - Is that the end of the cycle? *No.*
  - What can be done to continue the cycle? *The school needs to buy recycled paper.*



- And then . . . *it can be recycled again.*
- B. Discuss what type of products are made from recycled materials. See “Background Information for the Teacher.” List these on the chalkboard or a piece of butcher paper and save the list for discussion.
- C. Ask students whether they buy recycled products? Why or why not? *No, because there are no recycled products available for me to buy; they are too expensive; they are not as good as new.*
- D. Ask students whether they have ever heard of post-consumer and pre-consumer recycled paper? What do they think these terms mean? Explain that some paper that is sold as “made from recycled paper” is really made from paper that has never been used. This paper includes scraps and pieces obtained from paper manufacturing and printing companies. This type of waste paper is called pre-consumer because it was never used by consumers. On the other hand, post-consumer waste paper is paper that was used for printing or writing. Recycled paper with post-consumer waste is truly recycled paper. Most “recycled” paper contains a mixture of pre-consumer and post-consumer paper and some paper pulp made from nonrecycled fibers (which is necessary to add strength to the paper, because paper fibers lose their length and strength every time they are recycled).

**Homework Assignment:** Ask students to conduct an informal survey with at least two people on why they do not buy more products made from recycled materials.

## PROCEDURE

### Part I, Comparing the Properties of Paper Towels

- A. On the following day list on the chalkboard what the students found out about why people do not buy more recycled products. One of the possible reasons why people do not buy many recycled products is that they believe that products made from recycled materials are not as good as products made from nonrecycled materials. In this activity students will be designing and conducting tests to see whether recycled paper towels are as good as nonrecycled paper towels.
- B. Plan to set up stations for each test. Have students brainstorm and come up with ways they can test the paper towels for weight, strength, absorption, and cost. Show students the paper towels that they will test.
- C. Ask students to write a hypothesis (what they think the results of the experiment will show). Have the class or groups of students design a chart to summarize their findings.
- D. Students can work in groups and complete all tests, or two groups can be assigned to each test. One way to set up each test is described below:
  1. Weight—Weigh a sheet of paper towel on a balance scale; or weigh the entire roll and divide by the number of sheets to get a weight per sheet.
  2. Strength—Stretch a piece of paper towel between two desks and use duct tape to secure each side of the towel to each desk. Place washers on top of the towel until it tears; then count and record the number of washers. Do this with wet and dry paper towels made from both recycled and nonrecycled fibers.
  3. Absorption—Place a piece of paper towel in a container of water, have it absorb the water, and take it out, allowing it to drip back into the container. When it has just about stopped dripping, squeeze it into another container of water, and use a measuring cup or a graduated cylinder to measure the amount of water the paper towel held.
  4. Cost—Divide the cost by the number of sheets to get a cost per sheet, and then divide the cost by the length in inches indicated on the package to find out the cost per inch (assuming that both paper towels are the same width).
- E. Provide two types of paper towels to each group: one paper towel made with recycled fibers and one made without recycled fibers.
  - Have students conduct the tests.
  - Ask students to use the chart they designed and summarize their findings on the chart.
- F. Will the results of your experiment influence your buying habits? How? Why?

## Part II, Group Investigations About Products Made from Recycled Materials

- A. Share with students the following information:

Recycled products may cost more than those made from raw materials. This is because consumers do not pay the true price for the products made from raw materials. Our government gives tax breaks and subsidies to industries that harvest wood and mine minerals, which in turn are manufactured into products that consumers can buy at a relatively low cost. The health and environmental costs associated with mining and processing raw materials are also not included in the consumer's price. For example, a health and environmental cost would be polluted water from mine wastes or water used and polluted during the processing of raw materials.

**Note:** It is important that students be allowed to direct their own learning in the following section. The role of the teacher is that of a facilitator to provide guidance and answer questions if students ask for help. If a group fails to acquire the information or results it wanted, the students in the group should analyze what happened so that the experience becomes a learning experience. The students should make recommendations on what they could do differently next time.

- B. Tell students that they will work in groups to conduct various investigations concerning recycled products. Separate the class

Picture intentionally deleted.

Students in Tina Porter's science class at Curtner Elementary School conduct an experiment to test the strength of paper towels made from recycled fibers and paper towels made from nonrecycled fibers.

into groups of three or four students. Assign or have students select one of the four tasks on the sheet, "Instructions for Group Investigations Concerning Recycled Products." Then provide the instructions for each group. Note that some groups will have identical tasks but might have a different approach on how to gather information.

- Group 1 will research the cost of regular paper versus paper made from recycled fibers.
  - Group 2 will research the differences between recycled and nonrecycled paper by having different people observe, feel, write on, and draw on both types of paper.
  - Group 3 will also conduct research on the differences between recycled and nonrecycled paper by having group members observe, feel, write, and draw on both types of paper.
  - Group 4 will do research on items made from recycled plastics and other materials.
- C. Provide materials to group members. Make certain that all the groups design or invent an item that can be made from recycled materials. Remind students that in order to recycle, they will need to make a new item out of an old item. The groups should compile their findings and present these to the class.
- D. Show students the symbol and writing that indicate that an item is made from recycled material. Also show the symbol that indicates that the item is recyclable. Ask students if it is possible to get the two symbols confused and assume that an item is made from recycled materials, whereas the symbol indicates that it could be recycled.



**Homework Assignment:** Ask students to find five items in their homes that are made from recycled materials. For example, they can examine cereal boxes or other cardboard boxes that contain dry food and look for the label that indicates that the box is made from recycled materials. They can also identify in a store several products made from recycled materials.

- E. Ask students to share their homework assignments.

## DISCUSSION/QUESTIONS

Discuss with students:

- Is the list that we developed at the beginning of the lesson about products made from recycled materials accurate? If not, how should it be changed? Is it complete? What should be added?
- What did we find out about recycled and nonrecycled paper towels? *They were similar in quality.* Are there some recycled paper towels that could be better and others that could be worse than some brands of nonrecycled paper towels? *Possibly.*
- What did we find out about recycled and nonrecycled copy paper? *The paper seemed the same.*
- What happens to a recyclable item that is placed in a landfill instead of being recycled?

*It is buried and the natural resources used to make it are lost.*

- What would happen if there were no more natural resources to start the cycle? *We wouldn't be able to make new products.*
- What might the Earth look like if there were no more natural resources? *There wouldn't be any trees, soil, rocks, plants, animals, or water.*
- Why is it important to keep items in the recycling loop? *To conserve natural resources.*
- Why is it important to buy recycled products? *It supports markets so more items from recycled products will be made instead of using raw materials.*
- What is the difference between something made from recycled materials and something that is recyclable? *Recycled materials contain recycled products; recyclable means it can be recycled.*

## APPLICATION

- A. Ask students to present arguments verbally or in writing on whether recycled paper and other products made from recycled materials should be bought and used.
- B. Ask students to describe in writing and illustrations the steps on how to “close the loop” in the use of paper (as students did at the beginning of the lesson). The focus

Picture intentionally deleted.

Students in Tina Porter’s science class at Curtner Elementary School conduct an experiment to test the strength of paper towels made from recycled fibers and paper towels made from nonrecycled fibers.

should be on visually showing “closing the loop.”

- One way to do this is to have each group use arrows to draw the progress from tree to consumer in paper production; then add the steps for paper waste that is recycled and also that is placed in a landfill.
  - Have groups share their drawings.
  - Show the students the transparency of “Closing the Loop with Recycled Paper Products” and have students compare their drawings to the one on the transparency.
- C. Have students design an advertisement for a product made from recycled material. Encourage students to look at advertisements in newspapers and magazines and help them to identify how each advertisement encourages people to buy a product. For example, an advertisement might appeal to one’s emotion or sense of adventure; have a famous person endorse it; use the beauty of nature to sell the product; or show people having fun when using the product.

**Project Idea:** Have students encourage school officials to buy recycled products for the school. See the extension below to get students started on this project.

## EXTENSIONS

- A. Have students inventory current purchases at school to find out what recyclable materials are purchased. What materials made from recycled products are purchased? They can find out:
- What keeps people (e.g., school officials) from buying recycled paper for copiers? Why is it more expensive?
  - How can we buy recycled products, even if they are more expensive?
  - Is there a district that buys recycled paper? How did it get permission to buy recycled paper? The group should compile its findings and present them to the class.
- B. Have students make recycled paper (see the K–3 Module, Unit 2, Lesson 4). Students can then use the recycled paper, give it away as a gift for someone else to

use, or sell it. They can experiment with different types of paper, colors, or other types of fibers (e.g., from fabrics).

- C. Have students identify properties of recycled plastic to plastic that is not made from recycled materials.

## RESOURCES

### Videos

*Get Activated.* Green Earth Club 2 series. Ontario, Canada: TV Ontario, 1986 (15 minutes). Chatsworth, Calif.: Distributed by AIMS Media.

Describes experiments and projects students have done to become more knowledgeable about environmental problems, such as determining which toilet paper decomposes the fastest and writing about our environment.

*Our Own Space.* The Green Earth Club 2 series. Ontario, Canada: TV Ontario, 1991 (15 minutes). Distributed by AIMS Media.

Encourages students to make positive changes in their community. Shows students cleaning up litter, performing an audit at their school (what is bought, what is used, and what is thrown away), composting, and conducting research on a project.

*Recycling: The Endless Circle.* Washington, D.C.: National Geographic, 1992 (25 minutes).

Explains how recycling returns used materials to make new products, therefore reducing waste. The processes involved in recycling paper, aluminum, and plastic are described.

### Book

Chandler, Gary, and Kevin Graham. *Recycling.* Making a Better World series. New York: Twenty-First Century Books, 1996.

Contains information on various products made from recycled items, such as plastic lumber and biodegradable golf tees (an idea developed and patented by a thirteen-year-old boy).

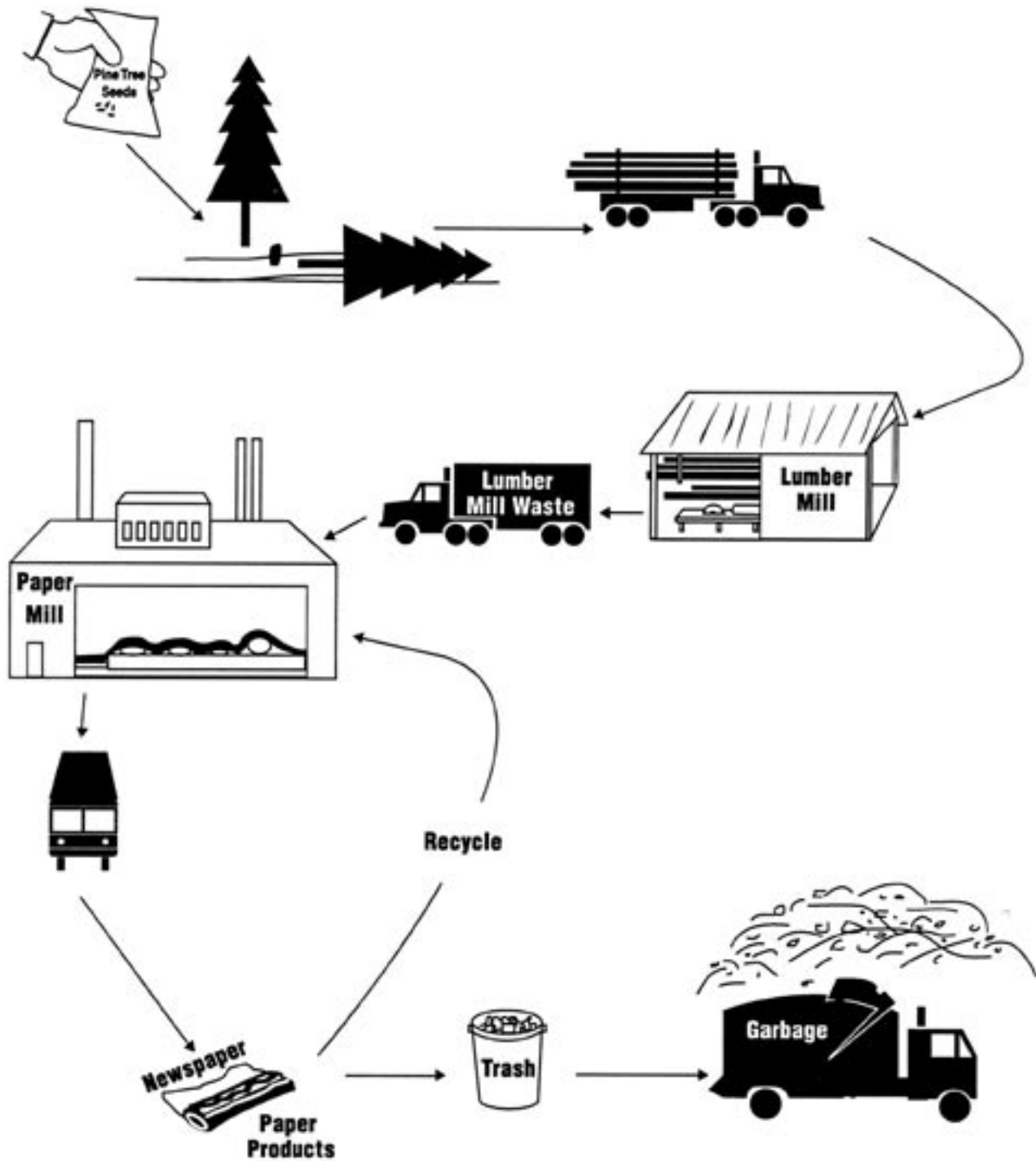
### Websites

See “Appendix F–V, Recycling websites” for a list of websites related to recycling.

## INSTRUCTIONS FOR GROUP INVESTIGATIONS CONCERNING RECYCLED PRODUCTS

<p><b>Group 1:</b> Research the cost of paper not made from recycled fibers to paper made from recycled fibers.</p> <ul style="list-style-type: none"> <li>• What kind of paper does our school purchase?</li> <li>• Why does our school purchase the kind of paper it does?</li> </ul> <p>Design or invent an item that can be made from recycled materials. Remember that in order to recycle something, you need to make a new item out of an old item.</p>	<p><b>Group 2:</b> Research the differences between recycled and nonrecycled paper.</p> <ul style="list-style-type: none"> <li>• Take the two papers and put a code on each kind so only you know which one is which.</li> <li>• Have different people feel, write on, draw on, and examine images that have been copied on them.</li> <li>• Record their ideas of which one is recycled and which one is not. (As a control, give the same kind of paper to some testers.)</li> </ul> <p>Design or invent an item that can be made from recycled materials. Remember that in order to recycle something, you need to make a new item out of an old item.</p>
<p><b>Group 3:</b> Research the differences between recycled paper and nonrecycled paper.</p> <p>Take ten sheets of each kind of paper and test each by writing, drawing, and copying on them; and observe any differences between the two papers. Compile your results.</p> <p>Design or invent an item that can be made from recycled materials. Remember that in order to recycle something, you need to make a new item out of an old item.</p>	<p><b>Group 4:</b> Do research on items made from recycled plastic and other materials. What kind of items are made from recycled materials? Compile your results.</p> <p>Design or invent an item that can be made from recycled materials. Remember that in order to recycle something, you need to make a new item out of an old item.</p>

## CLOSING THE LOOP WITH RECYCLED PAPER PRODUCTS



## BACKGROUND INFORMATION FOR THE TEACHER

After an item is recycled into another product, it is important for that item to be purchased by a consumer. When a one-time-use item is made, bought, and used by a consumer; discarded in a trash can; and then taken to a landfill, the energy and materials used to make that item are wasted. Additional natural resources and energy are needed to replace that item.

Most people assume that there will always be natural resources and energy sources to replace and manufacture new items. However, those natural resources (e.g., bauxite and other minerals) and energy resources (e.g., fossil fuels, such as petroleum and coal) that are not renewable are in limited supply. Once an object is in a landfill, it is usually no longer available for use again. This one-way or linear approach to managing waste often wastes natural resources.

When an item is recycled, the material is being reused to make a new item. This cycling approach is preferable because natural resources are conserved. Making products from recycled materials saves natural resources compared to using raw materials to make products. In addition, if recycled materials are used to make products, large amounts of energy needed to acquire and process the raw material can be conserved. However, the recycling process is not complete until the “loop is closed,” and that means buying products made from recycled materials. Manufacturing companies make what people buy, and if more people buy recycled products, more recycled products will probably be placed on the market. Consumers can increase demand when they buy products made from recycled materials.

Some paper that is sold as “made from recycled paper” is really made from paper that has never been used. This paper includes scraps and pieces obtained from paper manufacturing companies (e.g., the cut ends of paper rolls when these are cut to standard-sized paper) and printing plants. This type of waste paper is called pre-consumer, since it was never used by consumers. On the other hand, post-consumer waste paper is paper that was used for printing or writing. Recycled paper containing post-consumer waste is truly recycled paper and allows the consumer to “close the loop.”

Often recycled products are more expensive to the consumer and, therefore, offer little incentive for the purchaser. In some cases it is because there is not a high enough consumer demand to make large productions of the recycled materials. In other cases recycled materials might cost more because of the costs that manufacturing companies need to recover for purchasing new machinery or for modifying their existing machinery to handle recycled products.

Another reason that recycled products tend to cost more is because the consumer does not pay the true cost of items made from raw materials. Many laws and policies were developed many years ago when it was believed that the availability of natural resources was limitless. As a result, present government subsidies, tax breaks, depletion allowances, and cheap access to the use of public lands support many logging and mining industries.<sup>1</sup> This allows certain natural resources to be manufactured into products that consumers can buy at a relatively low cost.

If the true costs of items made from raw materials were charged, this would include health costs (associated with air and water pollution as a result of the manufacturing of raw materials) and costs for repairing environmental damage to the land caused by some improper logging and mining practices. When these costs are reflected in the market price, products made from raw materials would be much more expensive than those made from recycled materials.

Another obstacle to recycled goods is psychological—Americans tend to value new items, and those made with recycled materials may be viewed as “used” and therefore less desirable. In addition, many people do not see garbage as a problem and want the convenience of using something once, then throwing it away. Yet buying products made from recycled materials is part of the public’s responsibility for closing the loop. This helps to bring natural resources, once destined for landfills, back into the cycle to make new products and lowers the amount of raw natural resources needed to be acquired (e.g., through mining, extraction, harvesting).

<sup>1</sup>G. Tyler Miller, Jr. *Environmental Science: Working with the Earth* (Fifth edition). Belmont, Calif.: Wadsworth Publishing Company, 1995, pp. 348–349.

Many items are currently made from recycled material. These include copy paper, paper towels, toilet paper, cereal and other boxes; aluminum cans; and some plastics (benches, clothes, shoes, insulation in jackets).

Inventions, technology, and marketing are the key elements to make additional products out of recycled materials available to consumers.

Manufacturing companies should be encouraged to make products from recycled materials. Businesses need to use and promote these products and community members need to buy them.

Additional information on purchasing recycled products is provided in "Appendix B–III, Recycling."

### Some Catalogs That Feature Recycled Products

**Note:** The listing of a company catalog below does not imply endorsement or promotion of the company by the California Integrated Waste Management Board.

Animal Town  
P.O. Box 485  
Healdsburg, CA 95448  
1-800-445-8642

Co-op America  
1612 K Street, NW, Suite 600  
Washington, DC 20006  
(202) 872-5307

The Eco Zone  
RR2, Box 2210  
Brackney, PA 18812  
717-663-2962  
1-800-874-2310

Hammermill Papers  
2064 West 16th Street  
Erie, PA 16505  
1-800-892-5467

Harmony: Products in Harmony with the Earth  
360 Interlocken Blvd., Suite 300  
Broomfield, CO 80021  
1-800-869-3446

Real Goods  
555 Leslie Street  
Ukiah, CA 95482-5576  
1-800-762-7325

Signature Marketing  
134 West Street  
Simsbury, CT 06070  
(860) 658-7172



# LESSON 10: What Are We Reusing and Recycling at School?

## LESSON'S CONCEPT

Some school waste can be reused or recycled.

### PURPOSE

Students will identify the types of materials that are currently being reused and recycled at school and determine what they can do to add to the success of the reusing and recycling program.

### OVERVIEW

In this lesson students will:

- Conduct an audit by using a questionnaire and other methods of gathering data to determine what waste is being generated, what is being thrown away, what currently is being reused or recycled, and what could be reused or recycled at their school.
- Identify ways to make the existing reusing and recycling program more effective at school, or design a plan to start reusing or recycling at least one type of material if there is no reusing or recycling program at their school.
- Analyze the way their trash is handled at home, apply some of the waste minimization concepts learned at school in the home, and share what they learned with the class.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS

- Students participate in surveys and discussions about ways they can improve the existing reusing and recycling program or start such a program at their school.
  - Students “ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 26)
- Students conduct a home audit on reducing, reusing, and recycling waste. They write up their findings and include a plan for reducing their household’s wastes.

- Students “ask questions that seek information not already discussed.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 33)
- Students “use traditional structures for conveying information, e.g., chronological order, cause and effect, similarity and difference, and posing and answering a question.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 23)
- Students describe in their journals what they learned about the reusing and/or recycling program at school or what can be done to get such a program started.
  - Students “select a focus, an organizational structure, and a point of view based upon purpose, audience, length, and format requirements.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 23)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, ordering, classifying, relating

### TIME

20–30 minutes to prepare for the lesson;  
60–90 minutes to implement the lesson  
(More time may be needed, depending on how much students want to implement a reusing and recycling program at school or to improve the existing program.)

### VOCABULARY

Have the class select two vocabulary words that they learned in this lesson.

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. If your school has some type of reusing and recycling program, invite a speaker to your class who can answer some of the questions students have about what is being reused and recycled at school and who can identify some of the pluses and minuses of the school’s existing reusing and recycling program. If there is a recycling area at school, schedule a tour for your students.
- 3. If your school does not have a reusing and recycling program, invite someone from a school that has a reusing and recycling program. Staff from your school district or the California Integrated Waste Management Board, (916) 341-6769, could provide you with names of schools in your region that recycle and people to contact about their recycling programs.
- 4. Copy the “School Questionnaire on Reusing and Recycling” (page 426) for each group of students and the “Home Audit on Reducing, Reusing, and Recycling” (pages 427 and 428) for each student.

## MATERIALS

- The “School Questionnaire on Reusing and Recycling” for each group of students
- The “Home Audit on Reducing, Reusing, and Recycling” for each student

## PRE-ACTIVITY QUESTIONS

Do section “A” if your school has a reusing and/or recycling program. Do section “B” if your school does not have a reusing and/or recycling program.

- A. If your school has a reusing and/or recycling program, do the following:
1. Make a chart with the following headings on the chalkboard or on a piece of butcher paper and save until the end of this lesson:
    - What I know about the reusing and/or recycling program at our school
    - What I want to know about the reusing and/or recycling program at our school

### Recycling at Curtner School

We do recycle at Curtner. We recycle paper, milk cartons, and soda cans. In our classroom we have a box and in the box we put paper inside it and on Thursday we put it in a recycling bin.

I want to know where does all the the paper go? Does it go to the recycling center in San Jose?

I think each person should have their own recycling box so there won't be a bunch of paper inside the desks.

Submitted by Tina Porter, science teacher, Curtner Elementary School, Milpitas Unified School District.

- What I learned about the reusing and/or recycling program at our school
2. Ask students to write in their journals their responses to the first two statements in item section “A” step “1.” Then have students tell you what they know about recycling at their school and record this on the chart.
- B. If your school does not have a reusing and/or recycling program, have students come up with questions they might have on how they can start a schoolwide reusing and/or recycling program.

## PROCEDURE

Do section “A” if your school has reusing and/or recycling program. Do section “B” if your school does not have a reusing and/or recycling program.

- A. If your school has a reusing and/or recycling program, do the following:
1. Using the chart completed in “Pre-Activity Questions,” section “A” step “1” and the “School Questionnaire on Reusing and Recycling,” ask groups of students to volunteer to find the answers to some of the questions. This may mean setting up at least one interview.
    - Invite a speaker who is knowledgeable about your school’s reusing

and/or recycling program to your class to answer some questions.

- The day before the speaker comes to your class, develop with students some additional questions about reusing and/or recycling to ask the speaker.
- Allow students to practice interviewing other students. They should focus on being polite and listening carefully to the student being interviewed in the mock interview.
- Now they are ready for the real interview. Assign various students one or two questions from the “School Questionnaire on Reusing and Recycling” and from the questions generated by the class. These students should write down the speaker’s answers.

**Homework Assignment:** Ask students to describe in writing two actions that could improve the reusing and/or recycling program at their school. If applicable, encourage them to think about what they did to implement reducing and recycling in their classroom (from Lesson 2).

A way to improve Gold Trail recycling plan would be to label cans because people get confused of which is which. Also they might get some helpers to patrol to make sure people dispose of their trash properly. We might also simplify the process of disposing.

We can put the boxes of colored paper back into the rooms and start to recycle colored paper again.

Submitted by Janet Cohen, sixth-grade teacher, Gold Trail Elementary School, Gold Trail Union School District.

2. Have students develop a plan on how the current reusing and/or recycling program at their school could be improved.
  - Students can develop a questionnaire to survey other students, teachers, and other school staff members to identify what is working well in the current reusing and/or recycling program and what needs improvement.

- Then students can list several ways that the current reusing and/or recycling program can be improved. For example:
  - Adding another type of material to recycle, or reusing materials that used to be thrown in a trash can
  - Designing an advertising campaign to promote the existing reusing and/or recycling program
  - Renewing interest in the reusing and/or recycling program with awards, media events, or contests among different groups in school
  - Initiating a reusing and/or recycling educational program for other students, faculty, clerical staff, administrators, and custodians
- Discuss how students will be able to determine whether what they recommended will indeed be an improvement.

**B.** If your school does not have a reusing and/or recycling program, do the following:

1. Find out whether any other group is providing informal reusing and/or recycling services at your school, such as custodians, cafeteria staff, teachers, and/or local youth groups. Determine how you can work together with these groups. For example, if the custodians are already recycling aluminum cans, you might try to incorporate their activities into your program and share the additional revenues with them.<sup>1</sup>
2. With your class, visit a school dumpster when it is empty. Then visit the dumpster the day before it is scheduled to be emptied. Do this every week for one month.
  - Have students visually analyze what type of trash they saw the most of. Determine:
    - What could have been reused?
    - What could have been recycled?

<sup>1</sup>On the Road to Recycling! A Guide to Setting Up and Expanding Recycling Programs in San Francisco Schools. San Francisco: The City and County of San Francisco, 1992, p. 2.

- Students could also check the dumpster on a daily basis and record whether the dumpster is about one-fourth full, half-full, or entirely full.
- How quickly did the school dumpster fill up?
- If a special activities day was implemented, was there more waste generated that day? If so, how could the amount of waste be reduced?

**Homework Assignment:** Describe two things to consider when planning for a reusing and/or recycling program or what should be included in a reusing and/or recycling program. Students can contact a local recycler to get some answers or talk to their family members.

3. The next day compile a list of components of a successful recycling program. For example:
  - Use safe and easy-to-use containers.
  - Find an appropriate place to store the recyclables until they get picked up.
  - Arrange for someone to pick up recyclables on a regular basis.
  - Determine how and where materials will be stored for reuse.
4. For additional ideas, ask students to focus on what students are doing in their class's reusing and/or recycling program. Determine with students what is working in the classroom and what is not. If applicable, discuss how students could apply what they have learned about their class's reusing and/or recycling program to a schoolwide program.
5. If students want to actually implement a reusing and/or recycling program at school, they will need to develop a strategy for education, promotion, collection, storage, transportation, monitoring, evaluating, recording, and reporting the results of the waste reduction and recycling program. For the initial pilot, it is recommended that only one item be selected for reusing (e.g., white paper) and one item for recycling (e.g., white paper or aluminum) at school.
  - Locate a recycler/hauler who will accept materials for recycling.

Students will need to find out whether the garbage company that currently

services the school is willing to recycle the school's paper; whether this service would cost the school or would be picked up free of charge; or whether the recycling hauler would actually pay the school to recycle its paper.

- Determine how and where materials can be stored for reuse.
- Monitor the progress of the project, noting successful components and the aspects that need modification.
- Measure, record, and report the amount of material being reused and/or recycled.
- After a designated period of successful reusing and recycling, add to the program another type of material to recycle and another material to reuse.<sup>2</sup>

**Note:** In the "Background Information for the Teacher" is a list of tips for implementing a recycling program at school to help students in their implementation of a recycling program. Encourage students to develop a list for their school's reuse program.

## APPLICATION

- A. Discuss with students what they and other students could do to reduce (use less of in the first place) waste at school. These should be reasonable suggestions. Students can work in groups or as a class to make a list.

**Project Idea:** Have students select what they could do to reduce waste at school and develop a plan on how to implement it.

**Project Idea:** Have students find out what the school is recycling and determine what else can be recycled or what is currently being recycled that can be recycled more efficiently. They should develop a plan on how this can be done.

**Project Idea:** If there is no recycling program at school, students could organize a school recycling program, emphasizing collection and recycling of aluminum and paper.

**Homework Assignment:** Provide a copy of "Home Audit on Reducing, Reusing, and Recycling" to each student. Allow students several days to complete their audit. Then have students circle those items that they can reduce.

<sup>2</sup>A-Way with Waste: A Waste Management Curriculum for Schools (Third edition). Redmond, Wash.: Washington State Department of Ecology; Waste Reduction, Recycling and Litter Control Program, 1990, p. 226.

**Note:** If students cannot do the weekly audit, they can multiply their one-day figures by five or seven (have the class decide which) to get the numbers per week.

- B. Ask students to write up their findings and to include a plan for reducing their households' wastes. Assign at least four or five students to present their findings and their plans, and spend part of the class period discussing them.
- C. Do #1 or #2:
  1. If there is a reusing and/or recycling program at your school, ask students to write in their journals their responses to the "Pre-Activity Questions," section "A" step "1," "What I learned about the reusing and/or recycling program at school." They should write at least three paragraphs. Then discuss and record the students' responses on the chart.
  2. If there is no reusing and/or recycling program at your school, ask students to write in their journals their responses to what can be done to start a recycling program at their school. They should write at least three paragraphs.

## EXTENSIONS

1. Have students develop a plan to begin to reduce, reuse, and recycle at home (if the family is not currently recycling) or describe how to implement additional reducing, reusing, and recycling strategies in their household.
2. Share the following with students: You can persuade nearly everybody to reuse or recycle if it costs them more to throw things out than to reuse or recycle. For example, in High Bridge, New Jersey, garbage companies pick up recyclables at no cost to the consumer. But consumers have to buy a sticker for each regular trash bag they leave at the curbside. If the garbage haulers see a bag without a sticker, they will not pick it up.  
Have students describe in writing how this plan could work or not work in their neighborhoods.
3. Have students find out the cost of disposal practices at school, how much waste is being placed in landfills, and if applicable,

how much is being recycled. Discuss how the figures would change if students and school staff members would reduce the amount of waste going to the landfill and increase the amount being reused and recycled. How much money could the school or district save by reducing garbage? Students could contact their local government recycling coordinators for some answers.

4. Publicize the results of the school waste audit either in the school newsletter or local paper. Also publicize waste reduction tips and ask community members to participate in reducing the amount of garbage they generate.
5. Have several students find out what recycling programs are being implemented at other schools. Ask them to report the information to the class.

## RESOURCES

### Video

*Recycle That Trash*. Santa Monica, Calif.: Pyramid Film and Video, 1990 (18 minutes).

Shows students from the town of Goleta, California, participating in various recycling activities.

### Book

*The Recycler's Handbook*. Prepared by The EarthWorks Group. Berkeley: EarthWorks Press, 1990.

Contains information about why and how to recycle metal, glass, paper, plastic, organic waste, and other recyclables.

### Other Publications

*On the Road to Recycling! A Guide to Setting Up and Expanding Recycling Programs in San Francisco Schools*. San Francisco: City and County of San Francisco, 1992.

The following two publications are available through the California Integrated Waste Management Board's Office of Integrated Education at (916) 341-6769.

- *Seeing Green Through Waste Prevention*
- *A District Wide Approach to Recycling: A Recycling Guide to School Districts*

Names of students: \_\_\_\_\_

## SCHOOL QUESTIONNAIRE ON REUSING AND RECYCLING

Check off what is currently being reused, recycled, or could be reused or recycled; or that could not be reused or recycled at school.

Type of material	Already being reused	Already being recycled	Could be reused	Could be recycled	Could not be reused or recycled
<b>1. Types of paper:</b>					
a. White paper					
b. Colored paper					
c. Computer paper					
d. Newspaper					
e. Cardboard					
f. Construction paper					
g. Magazines					
h. Junk mail					
<b>2. Metals</b>					
a. Aluminum					
b. Tin cans					
<b>3. Plastics</b>					
a. PETE (pop bottles)					
b. HDPE (milk/ water jugs)					
c. LDPE (clear bags)					
d. PS (lunch trays)					
<b>4. Glass</b>					
<b>5. Wood products</b>					
<b>6. Material for com- posting</b>					
_____					
<b>7. Milk cartons</b>					
<b>8. Juice boxes</b>					
<b>9. Other</b>					

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## HOME AUDIT ON REDUCING, REUSING, AND RECYCLING

1. Does your neighborhood have a curbside recycling program?      Yes      No

2. What materials is your family currently recycling? Check all that apply.

\_\_\_ Aluminum cans

\_\_\_ Junk mail

\_\_\_ Glass containers

\_\_\_ Metal cans

\_\_\_ Cardboard

\_\_\_ Yard wastes

\_\_\_ Newspaper

\_\_\_ Other: \_\_\_\_\_

3. How many of the following did you reuse, recycle, or throw away (in one day and in one week)?

Type of trash	In one day			In one week		
	Reused	Recycled	Threw away	Reused	Recycled	Threw away
Aluminum cans (number of cans)						
Glass (number of bottles and jars)						
Paper (What type and how many sheets?) Example: <ul style="list-style-type: none"> <li>• Writing paper</li> <li>• Newspaper</li> <li>• Cardboard</li> <li>• Construction paper</li> <li>• Magazines</li> <li>• Junk mail</li> <li>• Other</li> </ul>						
Metal cans from soups, canned vegetables, etc. (number of cans)						
Plastics						
Other						

4. What type of material did you reuse the most? \_\_\_\_\_

\_\_\_\_\_

5. What type of material did you reuse the least? \_\_\_\_\_

\_\_\_\_\_

6. What type of material could you reuse more of? \_\_\_\_\_

\_\_\_\_\_

7. What type of material did you recycle the most? \_\_\_\_\_

\_\_\_\_\_

8. What type of material did you recycle the least? \_\_\_\_\_

\_\_\_\_\_

9. What type of material could you recycle more of? \_\_\_\_\_

\_\_\_\_\_

10. What type of material did you throw away more often than any other? \_\_\_\_\_

\_\_\_\_\_

11. List at least three items that your family reused and describe how each item was reused.

Item 1: \_\_\_\_\_

Item 2 : \_\_\_\_\_

Item 3 : \_\_\_\_\_

12. List four items that could be reduced.

Item 1: \_\_\_\_\_ Item 2: \_\_\_\_\_

Item 3: \_\_\_\_\_ Item 4: \_\_\_\_\_



# BACKGROUND INFORMATION FOR THE TEACHER

A school waste reduction and recycling program provides hands-on experiences for students to conserve natural resources and learn the business of establishing and maintaining a successful waste reduction and recycling program. It also encourages students to be responsible citizens at school, home, and in their community. In addition, the cost of disposal to school districts can be reduced, and the saved funds could be spent on instructional materials and/or field trips for students. The following are some suggestions for setting up a recycling program at your school.<sup>3</sup>

1. Obtain permission and support from administrators to explore the development of a recycling program at school.
2. Determine what can be recycled in your community.
3. Designate a coordinator to oversee the program.
4. Identify which items could or should be recycled at school. (Select only one or two at first.) A typical “waste stream” is 41 percent paper, 38 percent organic waste, 13 percent plastic, 6 percent metal, and 2 percent glass.
5. Find sources for the sale of the recyclable materials. Find out:
  - What materials will the hauler/recycler pay for? will haul at no cost? will charge for collection?
  - Will the recycler/hauler provide: containers? promotional material? transportation of recyclables from school?
  - What will be the frequency of service?
  - What is the minimum or maximum quantity accepted for collection?
  - Will the hauler/recycler monitor and report totals of materials being recycled?
6. Identify a location that is convenient for your school to set up recycling containers for one or two recyclable materials.
7. Determine how the material will be collected, separated, and stored.

<sup>3</sup>*A-Way with Waste: A Waste Management Curriculum for Schools* (Third edition). Redmond, Wash.: Washington State Department of Ecology; Waste Reduction, Recycling and Litter Control Program, 1990, p. 226.

8. Determine the number and type of containers necessary for recyclable items. Be certain that each of the containers is adequate for storing your material. Start small and build as opportunities present themselves.
9. Determine how the recycled material will be removed from the school grounds.
10. Establish a procedure for recycling.
11. Get support from organizations (e.g., service clubs could help coordinate the plan or construct recycling bins).
12. Present your proposal to the school board.
13. Implement your recycling plan.
14. Keep the site administrator involved. (If there are contracts to be signed, the site administrator will need to determine who the appropriate individual is to sign them.)
15. Advertise the recycling program throughout the school. Present skits, create a video, or invite the press for coverage.

The following are some problems that might need to be addressed concerning the recycling program:

- Equipment and storage needs
- Contamination or vandalism of recyclables
- Codes (health, fire, etc.)
- Poor participation rates
- Fluctuating markets that may affect the prices of recyclable materials

For additional information on setting up school and district recycling programs in California, contact the California Integrated Waste Management Board’s Office of Integrated Education, MS-14A, 1001 I Street, P.O. Box 4025 (mailing address), Sacramento, CA 95812-4025, (916) 341-6769.

**Note:** The purpose of the home audit is to inventory what is thrown away at home. The activity will give students a baseline of data for discussing with family members what can be done to prevent the dumping of otherwise reusable and recyclable materials in a landfill.

## NOTES

# LESSON 11: A Class or School Game and Reuse Day

## LESSON'S CONCEPT

Reusing materials helps to conserve natural resources and landfill space.

### PURPOSE

To provide students with experiences in reusing by having them organize a class or school "Game and Reuse Day."

### OVERVIEW

In this lesson students will:

- Name organizations and events that facilitate the reuse of old items.
- Work in groups to develop a game made out of discarded materials.
- Participate in an auction in which items brought to class by students are auctioned off.
- Organize a class or school "Game and Reuse Day" when games made out of discarded materials will be played and reusable books and toys brought by students will be won, bartered, sold, or exchanged.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students work in groups to develop a game out of discarded materials. They describe in writing the directions for making the game and the rules for playing it.
  - Students "write expository compositions (e.g., description, explanation . . .)." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 38)
  - "Students create original artworks based on personal experiences or responses." (*Visual and Performing Arts Framework, Visual Arts Education: Creative Expression Component*, Goal 4, page 101)

- Students organize a class or school "Game and Reuse Day." They visit other classes and advertise the event.
  - Students "deliver informative presentations about an important . . . event . . ." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 34)
- Students write a persuasive letter or composition about the "Game and Reuse Day," stating why it should or should not be organized next year.
  - Students "write persuasive letters or compositions." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 31)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, relating

### TIME

20–30 minutes to prepare for the lesson;  
45–60 minutes per day for five days to implement the lesson (to make the games and to play them)

### VOCABULARY

Have the class select one or two vocabulary words from this lesson.

### PREPARATION

1. Read the "Background Information for the Teacher" at the end of this lesson.
2. For the class auction, ask students to bring in one item to be auctioned.

They should get permission from their parent or guardian to donate it for the class auction.

- 3. For the reuse day, ask students to bring in books and toys (no more than five items per student) from home that they or their family members no longer want. Send a letter to parents and guardians home with students explaining the reuse project. (An example of a letter is provided in this lesson.)
- 4. Obtain several items (e.g., pencils, pens, books, and other items that students would want) to auction off in class.
- 5. Make copies of “A Plan for a Game Using Discarded Materials” for each group of two or three students (page 437).
- 6. If a school-wide event will be implemented, locate a place in which to conduct the games and the toy and book exchange, and obtain permission from school officials. If only a class event will be implemented, obtain permission from school officials to conduct this event in your classroom.

## MATERIALS

### *For “Part I, Designing Games Made from Reused Materials”*

- Art materials, such as water-based paints, paintbrushes, glue, masking tape, rubber bands, pipe cleaners, rulers, scissors
- Discarded materials from which to make games, such as:
  - Paper (e.g., colored construction, tissue, bags, newspapers, magazines, wall paper, shelf paper, envelopes, cardboard rolls from paper towels)
  - A variety of boxes (e.g., from cereals, shoes, laundry detergent; egg cartons; other cardboard boxes)
  - Plastic containers (e.g., shampoo bottles, 2-liter soda bottles, gallon water bottles, yogurt containers, margarine tubs)
  - Cans (aluminum and steel)
  - Textiles (e.g., towels, sheets, other fabrics, socks, ribbons, buttons)
  - Miscellaneous items, some of which might not be discarded items (e.g., popsicle sticks, string, balls)
- A copy of “A Plan for a Game Using Discarded Materials” for each group of two or three students

**Note:** The exact materials required will depend on the types of games that students will be making.

### *For “Part II, Participating in a Class Auction”*

- Several items that students would want that can be used for the example of a classroom auction (e.g., pencils, pens, books)
- Items that students brought in for the class auction
- Ten pieces of scrap paper for each student to use as “money” during the auction

### *For “Part III, Organizing a Class or School Game and Reuse Day”*

- Books and toys that students brought in for the reuse day
- Materials to publicize the event and for making signs at the event
- Ten pieces of scrap paper for each item brought by students to use during the “School Game and Reuse Day”

## PRE-ACTIVITY QUESTIONS

### A. Ask students:

- How is throwing away things that could be reused a waste? *They usually end up in a landfill and will not be used again; therefore, the natural resources used to make the items are wasted.*
- What are some things you no longer use that someone else could use?
- What events facilitate the reuse of old items? *Garage sales, flea markets.*
- What organizations facilitate the reuse of old items? *Churches and other charitable organizations, such as Goodwill, Salvation Army, Red Cross, Humane Society.*
- What other ways can we get items reused? *Individual exchanges, notification on bulletin boards or on the internet, donations to secondhand stores.*

### B. Discuss with students:

- What could we do as a class to make sure that the items we no longer want get reused?
- What events can we organize that reuses items? *Emphasize trading as a partial solution to decrease our solid waste and as a way to conserve natural resources.*

Suggest to students that a “game day” could be organized. For the “game day” they can make games from reused products and use some of the items brought in by students as prizes.

- Do we want to organize such an event?

## PROCEDURE

**Note:** If students do not want to organize a school-wide “Game and Reuse Day,” they can still make the games to play in their classroom and organize a reuse day only for their class.

### Part I, Designing Games Made from Reused Materials

- A. Tell students that they will be designing county fair-type games from reused materials.
  - Brainstorm with students games they have played at a county fair that were not computer games.
  - List their ideas on the chalkboard. (Some ideas for games are listed in section “B.”)
- B. Have students work in groups of two or three to design games from reused materials. Groups can select an idea from the brainstormed list or come up with one on their own.

**Note:** If a school-wide “Game and Reuse Day” will be organized, then these games need to be large enough to be set up on the school grounds for other students to play.

Examples of games are listed below:

- **Ring tossing.** Use a broomstick; or cut out of cardboard the shape of deer antlers or an octopus with arms sticking up; make rings out of cardboard to toss on the broomstick, antlers, or octopus arms.
- **Bean bag tossing.** Make a large frog out of cardboard and cut a hole for the mouth; make bean bags on which insects are painted to toss into the frog’s mouth.
- **Tossing an item through a hoop.** Make a hoop from a wire coat hanger; make the toss items out of discarded materials.
- **Bowling.** Make bowling pins by decorating paper towel rolls and filling them half full with heavy discarded materials to weigh them down; use a ball or bean bag to knock down the pins. Bowling pins can also be made from two-liter beverage

containers.

- **Fishing.** Attach string or yarn to a dowel; attach the other end of the string to a paper clip and bend the paper clip to make a hook; make cutouts of fish and add a base to them; punch a hole on top of the fish so the fish can be hooked by the hook on the line. Or, if you do not want to make a base for the fish, glue a paper clip to the mouth of the fish and bend the paper clip upward so that the fishing hook on the line can hook the fish that is lying on its side.
  - **Tossing an item into a cup.** Decorate egg cartons and use them for making caterpillars, trains, and flowers. Make sure that the egg depressions are facing up. Toss a bottle cap into a depression in an egg carton for a prize.
  - **Knocking down buildings and other items.** Build a village and make boats, trucks, or trains from various sizes of milk cartons and plastic beverage bottles. Use straws for axles and derricks. Use spools, buttons, or milk carton circles for wheels. Cut openings for windows and doors. Use a cord, knotted at one end, and string it through several milk cartons to make a train. Make bean bags to knock over buildings, trucks, or trains for prizes.
  - **Playing marbles.** Make small figures out of cardboard; paint straight lines inside a shallow box and set the figures at the end of each line. Use a marble to knock down the figures.
- C. Once students have selected a game to construct, ask them to complete a project sheet, “A Plan for a Game Using Discarded Materials.” They should include on the sheet what they are going to make, what it will look like, how they will make it, the materials they will need to make it, and the rules of the game.
  - D. Students should bring in and organize all their materials. Send a letter home explaining to the parents what the class is doing and how they can assist.
  - E. When students have completed making their games, allow the class to try all of the games and encourage students to make recommendations for improvement. You might want to have the students in each group decide

whether they will incorporate these recommendations.

## Part II, Participating in a Class Auction

- A. Stand in front of the class with the items that would be attractive to your students. Announce that you are from the “Three Rs Auctioneers.” Put on your best auctioneer’s hat and start an enthusiastic round of bidding, pitching heavily on the value of the first item. Tell students that since this is

### Milk Jug Toss



### Tray Toss



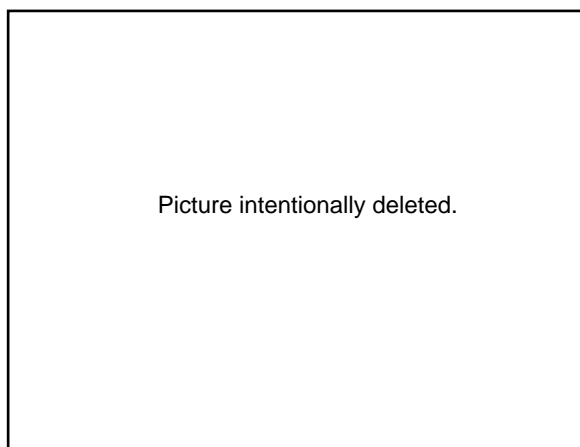
only a trial run, bidding for this item will not count. Ask students to describe how an auction works.

- Hold up different items that you brought for students and pitch each item’s value. See what the class thinks they are worth. After displaying several items and advertising their worth, proceed with the auction.
  - Provide ten pieces of scrap paper to each student to represent \$10. Auction one item that you got for students. Then have a student volunteer auction off another item. Continue the auction, allowing different students to be auctioneers, until all items have been auctioned off.
- B. Use the items that students brought to be auctioned (see “Preparation” step “1”).

### Cartoon Toss



### Can Bowling



Picture intentionally deleted.

Examples of games submitted by Janet Cohen’s sixth-grade students at Gold Trail Elementary School, Gold Trail Union School District.

(Use school's letterhead.)

Dear Parent or Guardian,

Please read the following information with your child:

As part of our study on reducing and reusing, we will be making games out of discarded materials. These games will be played at a school "Game and Reuse Day" on \_\_\_\_\_. Your child will be gathering materials for a game that his or her group has selected to design. Please help your child gather the materials needed for the game. The materials should be articles that were going to be thrown out, such as egg and milk cartons, paper towel rolls, and cardboard boxes. All containers should be rinsed well.

In addition, we will be having a class auction. Please send one item that can be auctioned in class. Each student will receive tokens to use to bid at the auction. No money will be exchanged.

Also, we will be having a book and toy exchange at the "Game and Reuse Day." If possible, please send books and toys (but no more than five items) to school with your child by \_\_\_\_\_.

Thank you,

- Give ten pieces of scrap paper to everyone who brought an item.
  - Hold a classroom auction, using the scrap paper for money.
- C. When the auction is over, ask students what they thought about the auction. Discuss with students:
- What was the thing about the auction that impressed you the most?
  - What can we do differently next time to improve our class auction?
- Part III, Organizing a Class or School Game and Reuse Day**
- Note:** It is important that students do all the organizing of this event. Avoid the urge to do the work yourself. The teacher's role should be that of a facilitator, guiding the students as they do the work. Additional information and issues to consider concerning the class or school "Game and Reuse Day" are listed in the "Background Information for the Teacher."
- A. Determine the scope of the class or school "Game and Reuse Day." Will this event include only your class or several classes that are implementing this curriculum, or will this be a school-wide event?
- Obtain permission from the administrators.
  - Acquire parental permission to trade objects for tokens or for other objects.
  - Determine the date the event will be held.
  - Determine what time of the day the event will be held (e.g., recess, lunch time, after school, during school).
  - Identify the exact location of the event.
  - List materials and other needs (e.g., tables, electricity, or water at the site) for the event.
  - Select an area where students can bring in the items on the day of the event.
  - Make signs to provide directions for the event.
  - Make "money" or tokens out of scrap paper.
  - Set up a first-aid station.
- B. After the logistics are worked out, and if other classes will be involved, ask your students to go to different classes and advertise the event, asking that each student in all other classes bring books and toys for the exchange (up to five items).

- C. On the day of the event, have your students:
- Give each student ten tokens for each item they bring. Students can also choose not to sell their item for tokens but, instead, trade an item directly for another item. They can also use tokens or aluminum cans to play a game.
  - Set up a bargaining table where students can exchange items.
  - Make a list of items that are brought in. This information will be used in the “Application” section “A.”
  - Select items (this can be done randomly so that all participants are treated fairly) which will be used as prizes for each game. Prizes can also be made from re-used materials (e.g., milk carton planters with plants in them).

## DISCUSSION/QUESTIONS

Discuss with students:

- Why is reusing items considered a better waste management action than recycling?  
*Reusing does not require the energy and resources needed to collect and recycle items into new items.*
- Are new things always better than used things? Are new models always better than older models? Explain your answer.
- How can a value be placed on each item? How do you decide how much something is worth? How do you decide what someone else might pay for it?

## APPLICATION

- Have students keep a list of what was traded and have them describe what natural resources were conserved as a result of conducting the school “Game and Reuse Day.”
- Have students determine what to do with any leftover items from the school game and waste exchange day. For example, the items could be donated to charitable organizations.
- Once the “Game and Reuse Day” is over, discuss with students what to do with the games that they designed.
- Ask students to write a persuasive letter or composition about the “Game and Reuse Day” stating why it should or should not be organized next year.

**Project Idea:** Have students organize a conserva-

tion and recycling fair to provide information on recycling and fun for the community.

## EXTENSIONS

- Conduct a school-wide contest for inventing games. A team of students can write up criteria for selecting games that will be used for the game day. All students creating games should be informed of these criteria. A variety of categories can be selected and recognition given to students winning in each category.
- Assign students to write want ads. They can put in requests for items for which they are looking; e.g., willing to exchange “X” item for “Y” item.
- Encourage students to explore the history of bartering. How was it used by Native Americans and Euro-Americans in the seventeenth, eighteenth, and nineteenth centuries? Students could conduct a research project on the history of bartering, selecting a specific time period or a specific region on which to focus. Then have students present their findings.
- Organize a reusable items drive and donate the things collected to a charitable organization.

## RESOURCES

### Books

Milne, Lyndsay. *Fun Factory: Games and Toys from Household Junk*. Westport, Conn.: Reader’s Digest Young Families, 1995.

Contains great ideas for organizing a play day, using reused materials.

Pfiffner, George. *Earth-Friendly Outdoor Fun: How to Make Fabulous Games, Gardens, and Other Projects from Reusable Objects*. New York: John Wiley & Sons, Inc., 1996.

Shows how to make games from discarded items.



Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

## A PLAN FOR A GAME USING DISCARDED MATERIALS

Name of the game: \_\_\_\_\_

1. Describe the game: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Describe how you will make the game: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. List the materials you need for the game: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. On the back of this sheet, please describe the rules of the game.

# BACKGROUND INFORMATION FOR THE TEACHER

Reusing items is part of waste prevention and is an important action for reducing waste. There are dozens of ways that we can give common discards a second life. Only an awareness of the possibilities and the willingness to be creative are required.

## Logistics for the Class or School “Game and Reuse Day”

Organizing a class or school “Game and Reuse Day” can be an extremely useful and educational activity. Before undertaking this project, a number of key questions should be answered about how it will work. The students should be asked about how to select and to manage the many possible parts. Consider the following questions and issues:

- Who will need to be contacted to obtain permission to organize this event? (This is usually the principal and the superintendent and sometimes the school governing board.)
- Will the exchange be a single event or a program lasting a few weeks or months?
- What will be the parameters of exchange; i.e., what is acceptable to bring in? (For example, for the first event, students can bring only toys and books.)
- What will be the “rate of exchange?” (For example, “tokens” can be given for each toy and book, but no more than five items can be brought in by each student. Students could also choose to make an even exchange of one item for another item. Students could win prizes by playing the various games. Tokens and aluminum cans can be used as payment to play each game.)
- What will happen to items not selected, won, or “bought”? (Items could be taken back by students bringing them; an auction could be held, using tokens or aluminum cans for

bidding; or, where appropriate, the leftover items could be taken to a charitable organization or secondhand store.)

- Can students donate items without taking something? (Students could receive tokens, which they can use to play the games.)
- How can you ensure that the event will not be a “dumping ground” for items no one would want? (One way is to limit the number of toys and books to no more than five items per student. Also, there could be “quality control” by a group of students who decide whether an item is acceptable.)
- What could be done if students cannot bring items to exchange? (Teachers or other adults could bring some items for these students.)
- How could parental permission for exchange items be managed? (A letter to parents and guardians could be sent home; students could also draft an official books and toys exchange form with a sign-off blank for parents or guardians; parents and guardians could be asked to participate in the event.)
- Who will manage this event? (The students should be doing most of the work, while teachers and parent volunteers act as guides.)

Whatever form the final program takes, it is important to establish some basic parameters for what is acceptable at the exchange, as defined by students. These should be described in writing and approved by all participants in the event.

If the reuse program is continued, it could be conducted during regular hours on specified dates. The program could be also continue and be run like a school store, managed by students, but with the exception that no money changes hands for the items.

# LESSON 12: Sharing What We Know About Reducing, Reusing, and Recycling

## LESSON'S CONCEPT

Showing and teaching others about reducing, reusing, recycling, and buying products made from recycled materials reinforce what students have learned and encourage others to participate in waste management.

### PURPOSE

Students will teach others about reducing, reusing, recycling materials, and the importance of buying products made from recycled materials.

### OVERVIEW

In this lesson students will:

- Work in groups to plan and complete a project, such as a display, newsletter, slogan, skit, or story, that will teach others about reducing, reusing, and recycling materials or that will encourage people to buy products made from recycled materials.
- Design a rubric to evaluate their projects.
- Present their projects to the class and decide which projects should be shared with the entire school.

### CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students work in groups to plan and complete a project.
  - "Students create original artworks based on personal experiences or responses." (*Visual and Performing Arts Framework*, Visual Art: Creative Expression Component, Goal 4, page 101)
- Students complete a project proposal form.
  - "By the end of the 5th grade, students should be able to write instructions that others can follow in carrying out

a procedure; make sketches to aid in explaining procedures or ideas . . . ." (*Benchmarks for Science Literacy*, page 296)

- Students present their projects to the class.
  - "Students deliver brief recitations and oral presentations about familiar experiences or interests that are organized around a coherent thesis statement." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 27)
- Students listen to presentations by their classmates, determine the main message that the project is portraying, and summarize major ideas.
  - Students "summarize major ideas and supporting evidence presented in spoken messages and formal presentations." (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 26)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, relating

### TIME

20–30 minutes to prepare for the lesson;  
45–60 minutes per day for five days to implement the lesson

**Note:** Allow plenty of class time for students to complete their projects, but agree with your students on a deadline. You might allow one hour per day (e.g., after lunch) for students to work on their projects. They can

also work on their projects quietly when their regular class work has been completed. For those students who finish their projects early, advise them on ways that their projects can

be improved or allow them to select other projects to complete.

## VOCABULARY

public service announcement, slogan

## PREPARATION

- 1. Read the “Background Information for the Teacher” at the end of this lesson.
- 2. Duplicate the “Project Proposal” for each project group (page 445).
- 3. Make a transparency of “An Example of a Rubric for a Reducing, Reusing, or Recycling Project” (page 444).
- 4. If you have not already done so, contact the local recycling coordinator or city or county solid waste director and find out what he or she does to promote the reducing, reusing, and recycling program. Ask to have brochures and other advertising materials sent to you and your class.

## MATERIALS

**Note:** Encourage students to reuse materials whenever possible.

- A variety of art supplies for students to use, including paints, crayons, felt-tipped pens, glue, scissors, rulers, scraps of construction and other paper; cardboard boxes.
- A copy of “Project Proposal” for each project group
- The transparency, “An Example of a Rubric for a Reducing, Reusing, or Recycling Project”

**Note:** Once students have determined how they will be presenting their information, you might need to obtain additional materials for them or encourage them to provide their own materials.

## PRE-ACTIVITY QUESTIONS

- A. Discuss with students what they have learned about reducing, reusing, and recycling materials and buying products made from recycled materials. What would they want to do with this information? (Some students might say that they would like to share what they have learned with others.)
- B. Ask students to describe some ways that we can show others (and teach others) what we

have learned about reducing, reusing, recycling materials and about the importance of buying products made from recycled materials. Make a list on the chalkboard or on a piece of butcher paper. Save this list for later use. Some ideas are listed in “Procedure” sections “A” and “D.” Discuss with students:

- Which of the ideas listed can help to promote a reducing, reusing, and recycling program at home? *e.g., showing and telling family members what we have learned.*
  - Which of the ideas listed can help to promote a reducing, reusing, and recycling program at school? *e.g., making presentations to other classes, making posters.*
  - Which of the ideas can be used to teach others in our community about reducing, reusing, and recycling materials and about the importance of buying products made from recycled materials? *e.g., make a display to set up in a library or other public location.*
- C. Have students add ways that we can teach others about reducing, reusing, and recycling materials and about the importance of buying products made from recycled materials.
  - D. Discuss with students the reasons why people use different ways to teach others about something. For example, slogans are used to attract attention and can promote a program. A play will entertain people and can also convey a message.
  - E. Discuss with students ways to persuade people to reduce, reuse, and recycle materials and to buy products made from recycled materials. Emphasize the importance of reinforcing people’s success with reducing waste and reusing and recycling materials. (People need to be reminded continuously until habits are changed.)

## PROCEDURE

- A. Ask students what they would like to do individually, in small groups, or as a class to show what they have learned and/or to teach others about reducing, reusing, and recycling materials. Some ideas are listed below, or students can develop their own ideas.

**Note:** For younger students, consider narrowing the list to two or three choices that you think your students could do easily. Also, if all grades in your school are implementing this unit, you could select one or two ideas for each grade level.

- Show how to recycle at home (e.g., how to set up various recycling bins at home and how to prepare newspapers or cardboard for curbside pickup).
- Show how to set up a recycling area in the classroom.
- Show how to reuse some items that are commonly thrown away.
- Show how reducing, reusing, and recycling conserves natural resources.
- Promote a reusing and recycling program at home (e.g., tell why it is easy and why it is important and how it can save money).
- Promote a reusing and recycling program at school (e.g., encourage students to reuse and recycle to conserve natural resources).
- Encourage people in the community to reuse and recycle items.
- Encourage people in the community to buy recycled products.
- Educate people about what can be recycled in their community.
- Educate people about the importance of buying products made from recycled materials.

- B. Refer to the list developed in “Pre-Activity Questions” section “B.” Ask students to select a project. Tell students that they can work by themselves, in small groups, or as a class, depending on the project they select. For example, a student might write a story individually, two students might design a slogan, or the entire class might produce a newsletter.

- C. If students decide to work individually or in small groups (instead of as a class), have them help you develop a rubric for these projects to identify what will be excellent, very good, acceptable, or unacceptable work.

- Project the transparency of “An Example of a Rubric for a Reducing, Reusing, or Recycling Project.”
- Have students help you complete the rubric so all students will know exactly what criteria will be used to judge their projects.

- D. Listed below are some ideas that students can implement:

- Before students actually do the activity, they should gather some examples of whatever media they choose to use. For example, the group that wants to design a slogan and logo for the school’s reducing, reusing, and recycling program should first gather examples of slogans and logos from magazines, newspapers, and publications from local businesses. If examples of some media (such as displays) are not available, students should first brainstorm what information can be included in a display about recycling.
- Distribute a “Project Proposal”<sup>1</sup> form to each student or group doing a project.

At first you might need to assist each group in getting started, but students should develop and implement their own ideas.

### Slogan and logo

Students should first obtain examples of slogans and logos. The slogan should be short and clear. The logo should be simple, yet should clearly represent the idea of reducing waste and reusing and recycling materials or the importance of buying products made from recycled materials. These can be placed throughout the school and in prominent places, such as the library and recycling center, and throughout the community.

### Poster

Have students locate examples of posters. Then they can design one of their own to promote or explain reducing, reusing, and recycling materials and/or the importance of

<sup>1</sup>Jacqueline Faber and Melissa C. Williams, *PBL: Beginning Steps—It’s a Process!* Paper presented at the Fifth Annual Conference on Project-Based Learning, March 10, 1997.

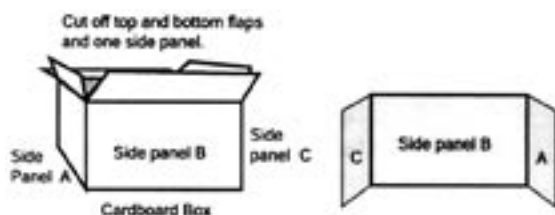
buying products made from recycled materials. Encourage students to use paper made from recycled fibers from which to make posters.

- Posters can be hung in local stores.
- If your local solid waste company sponsors a poster contest, students can be encouraged to participate in the contest.

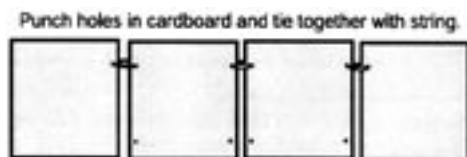
## Display

Students should first brainstorm the information that can be included in a display about reducing waste and reusing and recycling materials. This can include general information on how to reduce, reuse, and recycle materials. It can include ways for reusing an item. It can also include several different types of materials that can be recycled (e.g., aluminum, glass) or only one type of material that can be recycled (e.g., different types of paper, such as newspaper, white office paper, magazines, junk mail).

- Students can also do a display on the importance of buying products made from recycled materials.
- Students can make a display panel in one of the following ways, or they can come up with their own design:
  - Cut out three sides of a large box to form the backdrop for the display. The three-sided cardboard panel will look like those often used in science fairs.



- Another alternative is to cut four or five pieces of cardboard (approximately 8½ by 11 inches), punch two holes on one side of two panels and two holes on each side on the other two or three panels, and use yarn, twine, or ribbon to attach all of the pieces.



## Radio announcement

Students should first brainstorm the type of information that is usually included in a radio announcement; e.g., who, what, when, where, and why. Most announcements are between 30 and 60 seconds in length. A group can write and record on a tape recorder information about reducing, reusing, and recycling materials and/or buying products made from recycled materials.

**Note:** Before the announcement is actually aired, make sure that approval is secured from the school administrator.

## Newsletter

Students should first locate examples of newsletters. Next, students need to determine whether they will design the newsletter on a computer or by hand. Then they will need to decide the type of information that should be in the newsletter.

Each student should be responsible for a specific part of the newsletter. This can include:

- An editorial (e.g., what the student thinks about reducing, reusing, and recycling materials or about buying items made from recycled materials)
- A news report (e.g., a factual piece about how to reuse certain items or how to recycle materials or how a class recycles its materials)
- An advertisement for items made from recycled materials
- A cartoon (about reducing, reusing, and recycling materials or buying material made from recycled materials)
- An illustration (e.g., on how to reduce, reuse, or recycle)

One student will need to be the editor to direct the preparation of the newsletter. Another student can be the layout artist, who will lay out the copy and determine where each article goes.

## Poem or song

Students should first locate examples of a poem or song. Then they can write a poem or song (using an existing tune could help) about reducing, reusing, or recycling materials. For more information on this, see the K-3 Module, Unit 2, Lesson 5.

## Skit or Play

Students can write a skit or play about the importance of reducing, reusing, and recycling materials and/or buying products made from recycled materials.

## Story

Students can write a story about reducing, reusing, and recycling materials or buying products made from recycled materials. They should include the following components of a story:

- Setting—Where the story takes place
- Characters—The people (or plants and animals) involved in the story (There are usually one or two main characters and several minor characters.)
- Plot—A series of events (The story often starts with an introduction of the setting and characters. Then there is usually some type of conflict that needs to be resolved. In the climax part of the story, the conflict gets resolved and the story ends with some type of conclusion.)

It is helpful for students to read a piece of literature and identify the various parts of the story before they begin this project.

A prompt for the story can also be offered to students. For example:

- On my way to the landfill . . .
- Before I knew what happened, the garbage . . .
- The recycling center was . . .
- Cans were everywhere at the . . .
- The recycled products were. . .
- No one believed that this item could have been reused for . . .

## Bulletin Board

This bulletin board can be full of articles on reducing, reusing, and recycling materials; articles on buying products made from recycled materials; and diagrams and illustrations dealing with various solid waste topics.

Other ideas for projects are listed below:

- Essay
- Pamphlet
- Drawing

- Photo display
- Slides
- Video
- Commercial
- Bumper sticker

- E. Use the rubric that the students helped to design to evaluate each project. The class can also help to evaluate each project. Students can recommend ways the projects can be improved, but they should also describe positive aspects of each project.

## DISCUSSION/QUESTIONS

When groups have completed their tasks, ask them to present their projects to the class. Have the students who are listening to a presentation determine the main message that the project is portraying and ask them to summarize major ideas.

## APPLICATION

- A. Decide which projects should be shared with the entire school and develop a plan to share the information with other classes. Students might also want to enter some projects in a science fair.
- B. Have students share with the local solid waste company their campaign ideas. The company can give students ideas on who the target audience should be. Then a plan can be developed to reach that particular audience.

**Project Idea:** Students could develop a holiday display (Thanksgiving, New Year's Day, Valentine's Day, Fourth of July) to raise awareness about waste during the holidays and how to reduce it.

## EXTENSION

Have students conduct a pre-survey and post-survey to see whether their projects and campaigns made a difference; e.g., pre-survey and post-survey parents and students in other classes. Discuss different types of surveys; e.g., observations, questionnaire, random phone survey. Compare the results of the survey and share the information with the class and school.

## AN EXAMPLE OF A RUBRIC FOR A REDUCING, REUSING, OR RECYCLING PROJECT

1 (A)	2 (B)	3 (C)	4 (D)
1. The project is described in complete sentences, there is a clear sketch of the project, and the materials list is complete.	1. The project is described in complete sentences, there is a sketch of the project, and the materials list is complete.	1. The project is described and the materials list is complete.	1. The project is incomplete.
2. Materials were gathered and the project was started on time.	2. Materials were gathered and the project was started on time.	2. Materials were gathered.	2. Materials were not gathered and the project was not started on time.
3. All members stayed "on task" and actively participated.	3. All members stayed "on task" and participated.	3. All members stayed "on task."	3. Members did not stay on task.
4.	4.	4.	4.
5. Project is complete, neat, and easy to read.	5. Project is complete and neat.	5. Project is complete.	5. Project is not complete.
6. Project is presented to the class and includes visu-	6. Project is presented to the class.	6. Project is presented to the class.	6. Project is not presented to the

**Note:** Students will need to complete the row #4 in order to complete the rubric.



Student's Page

# PROJECT PROPOSAL

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

Project name: \_\_\_\_\_

What is your project? Briefly describe your project in complete sentences:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

What will your project look like? Draw a sketch. If you need more room, draw on the back of this sheet.

What materials will you need? Who will supply each item? List these.			
Material	Supplier	Material	Supplier
1. _____	_____	5. _____	_____
2. _____	_____	6. _____	_____
3. _____	_____	7. _____	_____
4. _____	_____	8. _____	_____

# BACKGROUND INFORMATION FOR THE TEACHER

In order to have a reducing, reusing, and recycling program that works, people need to know about the program and be willing to participate. To encourage people to participate, you must develop a good public education program. Sometimes just raising awareness of the problem and showing how easy it is to recycle can get people to move into action. Learning about the importance of buying products made from

recycled materials could motivate some people to buy these products.

The purpose of this lesson is to provide choices for students to present what they have learned in Unit 2. At the same time, they can promote reducing, reusing, and recycling at school, home, or in their community; and they can encourage people to buy products made from recycled materials.